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TOBY DAVID GRIFFEN

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A NEW WELSH CONSONANT SHIFT,
DESCRIPTION AND IMPLICATIONS

By

TOBY D. GRIFFEN

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PREFACE

The purpose of this work is twofold--to describe certain consonant phenomena in Welsh which may be indicative of a consonant shift in progress, and to introduce a nonsegmental phonology, termed hierarchical phonology. In describing the consonant phenomena, I use the transformational generative approach to synchronic and historical description, as this approach is perhaps the most widely used model in linguistics today.

The proposed hierarchical phonology is presently in the initial stages of development. In order to maintain the flexibility necessary to allow the model to develop freely, I use the basic functional/structural theoretical approach characteristic of the Prague school, especially as it is found in the works of Trubetzkoy and Jakobson. To this basic structure, I add the findings of experimental phoneticians, such as Mermelstein and Öhman, who have recently developed dynamic phonetic models for the study of speech production.

In order to describe the consonant phenomena in Welsh, I first must describe the phonology of the consonant subsystem, especially as regards the 'mutation system', a system of initial consonant gradation. Chapter 1 describes the phonological aspects of the system, while Chapter 2 treats the grammatical motivation associated with the mutations. Chapter 3 then introduces an area in which the otherwise regular system appears to become highly irregular. The irregularity of the system in the 'deviation' is attributed in Chapter 4 to a case

of historical change in which voiceless aspirated stops appear to be changing to voiced unaspirated stops. Further examination of these and related phenomena in Chapter 5 gives strong indications that the changes exhibited in the mutation system are indicative of a consonant shift and that the shift is presently in progress in the Welsh language. In Chapter 6, however, we find that the conclusion that a consonant shift is in progress in Welsh is based upon the acceptability of the generative description and that the generative description is in many ways faulty.

The hierarchical model is then proposed in an attempt to provide a more reliable description of Welsh and to incorporate recent evidence from phonetics into phonology. The notion that aspiration, a prosodic opposition, forms the basis of the Welsh consonant subsystem is introduced in Chapter 7 and supported by data from the spoken and written language. Using this prosodic gradual opposition as a base raises doubts as to the validity of a segmental phonology. Coupling these doubts with the phonetic dynamic models in which speech sound is described without recourse to segmentation, I then construct a basic nonsegmental model, or hierarchical phonology, in Chapter 8. This model is applied to the phenomena in Welsh in Chapter 9. Thus, Chapter 9 is the conclusion of the work, combining the hierarchical phonology with the consonant phenomena.

At the center of this hierarchical phonology is the notion that the phonology must reflect the evidence of phonetics. In keeping with this notion, Chapter 10 examines the evidence from acoustic and physiological phonetics supporting the prosodic gradual opposition of aspiration, upon which the consonant subsystem of Welsh is based, at least as it is presented in Chapter 9. The importance of establishing the phonological

structure of phonetic evidence cannot be overemphasized. By a carefully controlled procedure of abstracting only justifiable phonetic characteristics as oppositions, we can maintain a structure which is not only consistent but also reliable, at least as far as our current knowledge of phonetics will allow.

In order to facilitate understanding in the midst of frequent cross-references, I use a reference system for rules, figures, tables, etc., based upon the section numbers. For example, a rule referred to as rule 1.3 is the rule found in section 1.3. Where more than one such rule is found in a section, I use letters, such as rule 1.1.a, rule 1.1.b, etc. This system will hopefully prove more helpful than one using simply numbers in sequence.

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A NEW WELSH CONSONANT SHIFT,
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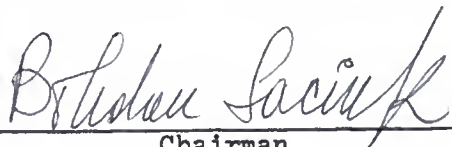
By

Toby D. Griffen

June, 1975

Chairman: Bohdan Saciuk
Major Department: Linguistics

In a generative description of the Welsh consonant subsystem, including the 'mutation system' (a system of initial consonant gradation), some irregularities in an otherwise regular system indicate that there may be a consonant shift in progress in which voiceless aspirated stops are changing to their voiced unaspirated cognates. In examining the evidence, however, several problems are found in the description, problems stemming from the nature of the generative description. Developments in phonetics, especially the recent physiological and acoustic dynamic models which describe speech without segmentation, are then combined with a reanalysis of Welsh based upon the prosodic gradual opposition of aspiration, in order to create a nonsegmental approach to phonological description, termed hierarchical phonology. This hierarchical phonology is used to provide a more regular description of the Welsh consonant subsystem, a description more closely based upon findings of experimental phonetics.


Chairman

CHAPTER 1

THE PHONOLOGY OF MUTATION

1.0 The Mutation System. It is a property characteristic of Celtic languages that the initial consonant of a word will vary depending upon the grammatical, that is, morphological and syntactic, context affecting the word (compare Lewis and Pederson 1937). This system of initial consonant gradation is termed the 'mutation system'.

Through its relationship with grammatical contexts, the mutation systems of the Celtic languages function in much the same way as the inflectional systems of languages such as Latin. For example, in Latin an adjective modifying a first declension feminine noun in the nominative case will have to agree in number, case, and gender with that noun. In Modern Welsh, on the other hand, the adjective modifying a feminine noun will undergo a particular mutation--a change in the initial consonant. Furthermore, in Latin a noun which is the object of the verb will be marked by a particular inflectional ending, usually the accusative. In Welsh, however, the object of an inflected verb will undergo a particular mutation of the initial consonant.

Throughout the Celtic languages, the changes of initial consonants reflect a certain systematicity. One type of mutation may be thought of as exhibiting a process of lenition, another of nasalization, and another of frication. As I demonstrate below, these changes are indeed regular applications of processes representing certain phonetic characteristics (or, at least, they can be described in this manner). These

mutations are, then, as Hamp 1951 points out, morphophonological.

In Modern Welsh, the mutations are dependent upon the grammatical context. Although the system is now morphophonological, it developed from phonological alternations that existed during the transition from Brythonic to Old Welsh (up to about the end of the eighth century-- Morris Jones 1913:6). For example, when Brythonic */m/ occurred between vowels, it was realized in Old Welsh as /β̃/, a voiced bilabial nasal fricative, in Modern Welsh as /v/. At the same time that these phonological alternations were taking place, the final syllables of Brythonic words were being lost, including the feminine ending */a/. Thus, the */m/ in Brythonic *oinos markos */oinos markos/ 'one horse' is realized as /m/ in Modern Welsh un march /ɪn marx/, as there is no vowel before the */m/ to cause the phonological change in the Brythonic word; while, on the other hand, the */m/ in Brythonic *oinā mammā */oina: mamma:/ 'one mother' is realized as /v/ in Modern Welsh un fam /ɪn vam/, as there is a vowel before the */m/ which caused Brythonic */m/ to be realized as Old Welsh /β̃/, Modern Welsh /v/ (see Morris Jones 1913:161).

Although the phonological context was sufficient to bring about alternations in the Brythonic-to-Old Welsh period, it is not sufficient (nor even necessary) to cause alternations now. The examples above should show that there is no phonological motivation for the change in Modern Welsh.

The usual way of depicting the mutation system in Modern Welsh in the standard orthography (see Bwrdd Gwybodau Celtaidd 1942), is presented in Table 1.0.a. The phonological segments corresponding to the orthography in Table 1.0.a can be found in Table 1.0.b.¹

The left-hand column in the tables contains the segments known as

'radicals'. The radical segment is the one listed in the dictionary. For example, the word 'mother' in the example above would be entered as mam, regardless of the fact that it is realized in that particular phrase as fam.

Whenever none of the mutation rules apply, the radical is the segment realized. Moreover, where a blank space occurs in the tables, the radical is realized. For example, in the grammatical context of spirant mutation, mam /mam/ would simply be realized as mam /mam/, there being no spirant mutation form of /m/.

Within these initial chapters (1 through 5), in which I describe the new Welsh consonant shift and present arguments for it, I utilize basically the transformational-generative framework, as found in Chomsky and Halle 1968. The notation which I use, however, is that of Schane 1973, as this notation is compatible with the notations of most other schools of linguistics and it allows us to differentiate between a phonological segment (in slashes--/ /) and a phonetic segment (in brackets--[]) The underlying segment is enclosed in vertical bars (| |).²

In the generative framework, the mutation system of Modern Welsh is expressed as a series of rules which derive a phonetic segment from an underlying segment. This item-and-process framework (see Hockett 1954) assumes, then, that there is an item at an abstract 'deep' level which is transformed through orderly processes into an item at the 'surface' level. Thus, for every line in the mutation tables, there is an underlying segment (not to be confused with the morphophoneme of Hamp 1951, which is an abstraction of surface oppositions), and this underlying segment undergoes various process rules in order to generate the surface phonetic segments.

Table 1.0.a
The Mutation System--Othography

radical	soft mutation	nasal mutation	spirant mutation
p	b	mh	ph
t	d	nh	th
c	g	ngh	ch
b	f	m	
d	dd	n	
g	(deletes)	ng	
m	f		
ll	l		
rh	r		

Table 1.0.b
The Mutation System--Phonological Transcription

radical	soft mutation	nasal mutation	spirant mutation
p	b	ph ^c	f
t	d	th ^c	θ
k	g	kh ^c	x
b	v	m	
d	ð	n	
g	(deletes)	ŋ	
m	v		
l ^a	l		
r ^b	r		

^a/l/ is a voiceless lateral fricative.

^b/r/ is a voiceless trill.

^cThese are voiceless aspirated nasals.

In the case of the mutation system, I consider the underlying segment to correspond to the radical. There are several reasons for positing the radical as the underlying segment. First of all, the radical is the dictionary form, considered by the native speaker to be the basic form. It is the Welshman's intuition (and the traditional way of teaching the system) that the mutation forms are derived (via 'mutation') from the basic radical. In fact, according to Professor Ceinwen Thomas of the University of Wales at Cardiff (personal communication), when a Welshman is shown the word phen /fen/ (spirant mutation form of pen /pen/ 'head')³ without the grammatical context, he is generally at a loss as to how to translate or define it, until it is put in its radical form.

In addition to the intuition of the native speaker, there are also distributional considerations for treating the radical as the underlying form. As stated above, where there is no nasal or spirant mutation form, it is the radical which is realized. Moreover, the radical is realized in the absence of a rule within the system itself. Thus, it would appear that the radical is the underlying form, as it is the neutral segment (unmarked in the Prague sense of the term--see Trubetzkoy 1969).

As we turn our attention to considerations more closely associated with generative methodology, we can see that the various mutations can be derived from the radical with fewer feature changes than they can from any other mutation form. For example, the nasal and spirant mutations share more features (per line in the tables) with the radical than they do with the corresponding soft mutation segment. Thus, greater simplicity in phonological rules can be realized if we posit

the soft mutation forms as underlying.

Perhaps the best motivation for positing the radical as the underlying segment is the fact that all mutations can be predicted from the radical, but the radical cannot be predicted from all mutation forms. For example, there are two occurrences of /v/ in the soft mutation, one of which corresponds to the radical /b/ and one to the radical /m/ (compare Fowkes 1949:208; Griffen In press a). Given underlying |v|, then, we would be at a loss as to whether to derive /b/ or /m/ in the radical environment. Given underlying |b| and |m|, however, we would have no problem deriving /v/ in the soft mutation environment. This is an important consideration, for the generative model has formal, explicit rules operating from deep to surface structure, but not from surface to deep, as shown in Chomsky and Halle 1968:294 (see also Griffen In press a). As such, then, cases of diversification which cannot be predicted in this formalism are to be avoided at all costs, and only the radical can assure us of no diversification.

Temporarily leaving the generative framework, if we were to view the phonology as a series of abstractions from the acoustic data, then we might consider this underlying form to be the most basic segment. In the terminology of Trubetzkoy (1969:Chapter 4; compare also Venemann 1972), it is the least marked segment with respect to the distinctive oppositions (such as voice, nasality, and continuance). In such a framework, the underlying segment (the morphophoneme) would become marked for various distinctive features in the process of the phonological rules. Of course, the one feature (opposition) that is constant throughout this process of marking the basic segment is the phonological position of articulation.⁴

This notion of abstraction is not a part of generative phonology as found in Chomsky and Halle 1968. Nevertheless, it is a useful way of viewing the mutation system. Of course, in a rigorous generative description, we can only use the analysis-by-synthesis methodology developed in Halle and Stevens 1964 and Chomsky and Halle 1968.

As this is a generative description, the rules and segments used herein must be specified by distinctive features. I therefore list the features and their specifications for the consonants of Cymraeg Safonol (that is, the Standard Welsh--see, for example, Watkins 1961) in Table 1.0.c. The features used are those found in Chomsky and Halle (1968: Chapter 7). Instead of heightened subglottal pressure, however, I use aspiration. The justification for using aspiration as a distinctive feature in addition to voice in Welsh is provided in Chapter 7. The feature trill is necessary as a means of distinguishing /θ/ from /r/. I do not include the affricates, and I do not deal with them in this study. These are, however, treated in Griffen 1974b (see also R.O. Jones 1971).

1.1. Soft Mutation. As we can see in Table 1.0.b, the soft mutation, also known as lenition, cannot be characterized by any one single feature change using the binary features of Chomsky and Halle 1968. In fact, the soft mutation cannot be described within the generative framework as a single phonological rule.

Nevertheless, there is a degree of phonetic unity within this process, because each rule in the soft mutation serves to create a segment which is more lenis (or soft--see Malmberg 1963:52) than the underlying segment. In strictly binary features, this lenition process

Table 1.0.e
The Consonants of Welsh

	p	t	k	b	d	g	ŋ _o h	ɣh	ŋ _o h	m	n	ŋ	s	θ	f	x	v	ð	ɬ	ɮ	l	r	h	w	y
Obstruent	+	+	+	+	+	+	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-
Consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-
Vocalic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
High	-	-	+	-	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-	-	-	-	-	+	+
Back	-	-	+	-	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-	-	-	-	-	+	-
Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Anterior	+	+	-	+	+	-	+	-	-	+	-	-	+	+	+	-	+	+	+	+	+	-	-	-	-
Coronal	-	+	-	-	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	+	+	-	-	-
Round	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Aspirated	+	+	+	-	-	+	+	+	+	-	-	-	+	+	+	+	-	+	+	+	-	+	-	-	-
Voiced	-	-	-	+	+	+	-	-	-	+	+	+	-	-	-	-	+	+	+	+	+	-	+	+	+
Continuant	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
Nasal	-	-	-	-	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Strident	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+	+	-	-	-	-	-	-	-
Lateral	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-
Trill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-

must be described through other binary features (compare Cherry, Halle, and Jakobson 1953; Vennemann and Ladefoged 1973). I return to this issue in section 6.1.

The soft mutation can be divided into five generative phonological rules. These are posited as follows:

$$\begin{array}{ll} \text{a. } |p| \rightarrow /b/ & \\ |t| \rightarrow /d/ & \left[\begin{array}{c} -\text{vcd} \\ +\text{asp} \end{array} \right] \rightarrow \left[\begin{array}{c} +\text{vcd} \\ -\text{asp} \end{array} \right] / \left[\begin{array}{c} +\text{obs} \\ -\text{cnt} \end{array} \right] \\ |k| \rightarrow /g/ & \end{array}$$

In other words, all voiceless aspirated stops become voiced and unaspirated. Of course, this rule assumes the proper grammatical context, which I posit in detail in the next chapter.⁵

The advantage of the feature specification notation in phonological rules is that it allows us to capture a generalization. In this case, voicing and deaspiration take place in this class of segments under soft mutation regardless of the position of articulation. Moreover, this rule demonstrates a change in an entire natural class.

The notion of a natural class is central to this description. According to Harms (1968:26), there are two considerations involved in the notion of a natural class: 'First, it is a class of segments that can be specified with fewer features than any individual member of the class.... Second, the features shared by the class members should be limited to those which have a certain degree of phonetic plausibility.' Recall that in rule 1.1.a we do not specify any features of position of articulation (such as back, anterior, and coronal), because the rule affects all stops regardless of position. Thus, the first consideration of a natural class is satisfied. As for the second condition, there

should be little argument as to the plausibility of the class of voiceless aspirated stops within the phonetic system. This class has been one of the traditional classes in linguistic description--the aspiratae (as opposed to the *tenuēs* and *mediae*).

Within the generative framework, then, the voiceless aspirated stops (*aspiratae*) function as a single class. In the remaining soft mutation rules, however, we cannot form such a neat generalization within this framework.

The voiced unaspirated stops undergo the following changes:

$$\begin{array}{ll}
 \text{b. } |b| \rightarrow /v/ & [+obs] \rightarrow [+cnt] / \begin{bmatrix} +vcd \\ -bck \end{bmatrix} \\
 |d| \rightarrow /ð/ & \\
 \text{c. } |g| \rightarrow \emptyset & \begin{bmatrix} +obs \\ +vcd \\ +bck \end{bmatrix} \rightarrow \emptyset
 \end{array}$$

There are two aspects of rules 1.1.b-c which are somewhat disconcerting. The first (and more minor) is that there appears to be a connection in this rule between continuance and nonbackness. That is to say that we might want to find a relationship between the notion of continuance and that of nonbackness. What relationship there may be, however, is purely a negative one--nonbackness is introduced merely as a means to block the rule from applying to $|g|$.

The other disconcerting aspect of these rules is that fact that $|b|$, $|d|$, and $|g|$ are members of a natural class but they do not undergo a common rule. This problem has been approached by Zwicky 1974, in which an intermediate $/\gamma/$ is posited. This allows for the natural class to undergo a common rule, but it adds another rule to the grammar-- $/\gamma/$ must be deleted wherever it occurs. Now historically, there was

indeed a /ɣ/ as the soft mutation form of |g| (Morris Jones 1913:161). Resurrecting such a segment merely for the purpose of deleting it, however, is a questionable practice. We must bear in mind that in the generative item-and-process framework, such an intermediate form is an item in the derivation, not simply a place-holder to demonstrate the incompatibility of certain features, and as an item its creation must be fully justified.

Returning once more to the initial disconcerting aspect, the use of nonbackness to block the application in one member of a natural class, we can see a bothersome question in the absence of the historical /ɣ/. As the inclusion of the bilabial and the apico-dental voiced stops in a single rule requires fewer features and the pair are clearly to be classed together, is what we have truly a natural class? Is the class of /b/ and /d/ without /g/ an entire natural class? Clearly the segments represented in rule 1.1.b do not represent as much of a natural class as those represented in rule 1.1.a.

The next soft mutation rule is as follows:

$$d. |m| \rightarrow /v/ \quad \begin{bmatrix} +cns \\ -voc \end{bmatrix} \rightarrow \begin{bmatrix} +cnt \\ -nas \end{bmatrix} / \begin{bmatrix} +vcd \\ +ant \\ -cor \end{bmatrix}$$

As mentioned above, historically there was an intermediate stage in which /β/ is used. Although we could gain simpler rules from a stage using /β/ between |m| and /v/, such a stage would be as unmotivated as the proposal for using /ɣ/ in our synchronic description. Note should be taken that through soft mutation, |b| and |m| neutralize into /v/. This fact could prompt us to write a rule whereby voiced labials, regardless of nasality, become fricatives. This would, however, complicate

the rules, as a rule affecting [d] would have to be included separately (unlike [m], [n] undergoes no mutation).

Finally, there is the following soft mutation rule:

$$\begin{array}{lcl} \text{e. } [l] & \rightarrow & /l/ \\ [r] & \rightarrow & /r/ \end{array} \quad [+ \text{con}] \rightarrow [+ \text{voc}] \quad / \quad \left[\begin{array}{c} + \text{lat} \\ + \text{trl} \\ + \text{cnt} \end{array} \right]$$

Here again, there is a problem with natural classes. Although the output of rule 1.1.e clearly forms a natural class, the class of liquids, the input does not. It is difficult, then, to make any insightful statement about the natural class involved in this rule.

Rule 1.1.e makes use of a notational device known as 'braces'. The question needs to be asked as to whether this is one rule or two. By leaving features unspecified, such as the position of articulation features in 1.1.a, we collapse rules into a more general statement. The braces, on the other hand, do not represent a generalization, but stand for the logical exclusive 'or' relationship. As each application of each rule is a singular entity in a temporal (linear) plane, it could be argued that the effect of rule 1.1.e is that of two rules, and the method of collapsing the rules is merely a notational convenience rather than a statement of generalization.

According to Chomsky and Halle (1968:333), 'two partially identical rules may be coalesced into a single rule by enclosing corresponding nonidentical parts in braces.' As the interpretation of Chomsky and Halle is clearly that the braces collapse two rules into one, I treat rule 1.1.e as a single rule. The objection, however, ought to be considered from a logical viewpoint.

Thus, given the notion that rules 1.1.b (in spite of the fact that

it implies a relationship between continuance and nonbackness and works to exclude a natural class) and 1.1.e (in spite of the logical considerations regarding the braces) each represent a single rule, the soft mutation of Modern Welsh can be represented in five rules. I do not believe that a credible argument could be made for collapsing the rules any further, as any simplicity that could be gained from collapsing the rules so as to create fewer rules would in turn be lost in the extreme complexity of the rules themselves.

So far, I have not given any examples of the application of these mutation rules. The rules are intricately connected with their grammatical contexts,⁶ and I give examples of them in Chapter 2, where I address these contexts.

1.2 Nasal Mutation. The soft mutation is described in five generative rules. Even if these could be collapsed further, the fact would remain that in the feature system of Chomsky and Halle 1968, which is necessarily binary, there are five processes involved--voicing, continuance, deletion, continuance and denasalization, and vocalization and voicing. The nasal mutation, on the other hand, can be described in only one rule. This rule can be written as in 1.2.c, below.

We should notice that in rule 1.2.c, the voiceless aspirated stops (*aspiratae*) and the voiced unaspirated stops (*mediae*) together form the natural class of all stops. This is reflected in the notation by the use of a minimum of features. Nonetheless, I split the rule into two rules in order to maintain the notion that voiceless aspirated stops and voiced unaspirated stops are indeed two different natural classes in the operation of the mutation system (compare also section 1.3), and the

nasal mutation, according to Professor Robert Owen Jones of the University College of North Wales at Bangor (personal communication), can be thought of as aspirated stops becoming aspirated nasals and unaspirated stops becoming unaspirated nasals (see Griffen 1974b:159).

The two rules and the collapsed single rule are written as follows:

- a. $|p| \rightarrow /_{\phi}^{mh}/$
 $|t| \rightarrow /_{\phi}^{ph}/$
 $|k| \rightarrow /_{\phi}^{nh}/$
- $[-nas] \rightarrow [+nas] / \begin{bmatrix} +cns \\ -voc \\ -vcd \\ +asp \end{bmatrix}$
- b. $|b| \rightarrow /m/$
 $|d| \rightarrow /n/$
 $|g| \rightarrow /v/$
- $[-nas] \rightarrow [+nas] / \begin{bmatrix} +cns \\ -voc \\ +vcd \\ -asp \end{bmatrix}$
- c. $[-nas] \rightarrow [+nas] / \begin{bmatrix} +cns \\ -voc \end{bmatrix}$

As Modern Welsh has no segments that are both nasal and continuant ($/\tilde{\beta}/$ is found in Old Welsh but changes to $/v/$, as mentioned above), there is no need to specify continuance in these rules (at least by the feature criteria of Chomsky and Halle 1968).

As stated above, there is certainly a natural class of stops (though it must be subdivided into two classes in soft mutation), and this natural class becomes nasal in the nasal mutation. In effect, then, there is only one nasal mutation rule (1.2.c). On the other hand, the voiceless aspirated stops and the voiced unaspirated stops act quite differently in the other mutations. Now this fact does not make all stops less of a natural class in the nasal mutation, but it does necessitate our examining the two classes of stops separately in a number of operations

in which they could be considered a single class. Moreover, it becomes necessary to refer to the aspiration of the nasal segments in 1.2.a as distinct from the lack of aspiration in 1.2.b, especially as this aspiration may be vital in the productive nature of certain mutations.

One other aspect of the nasal mutation which becomes important in this study should be mentioned. The voiceless aspirated nasals are only found as a result of mutation--they are nowhere found as underlying segments. The aspiration involved, moreover, is not the same degree as that found in the underlying voiceless stop. In fact, it is so strong that R.O. Jones 1969 describes it as a glottal fricative. This fact should be kept in mind, as it is particularly crucial to the arguments presented (see Chapter 7).

This heightened aspiration is always realized as the pure [h] fricative, even if the corresponding stops are (noncontrastively) affricated. For example, Mrs. Mona Pringle of Gainesville, Florida, is a native speaker of the Colwyn Bay dialect of North Welsh. Although her English /t/ is aspirated [t^h], her Welsh /t/ is affricated [t^s]. Nonetheless, this affrication has no effect upon her nasal mutation forms, which are realized with the heightened aspiration [h].

As pointed out in Griffen 1975, the aspiration of the voiceless stop is sufficient to devoice the following liquid but not the following nasal. The heightened aspiration of the nasal mutation form, on the other hand, is sufficient to devoice the following liquid or nasal, and as shown in section 7.1, it continues into the vowel following the liquid or nasal. Thus, for example, in the Bangor dialect penelin [pnelin] 'elbow' is realized in nasal mutation as mhenelin [m^hnelin] (see Fynes-Clinton 1913:436), and that of pleth [p^hle:θ] is [m^hle:θ]

(Fynes-Clinton 1913:432).

1.3 Spirant Mutation. The final mutation which affects consonants is the spirant mutation. This mutation also has the most restricted range of application, affecting only voiceless aspirated stops. The spirant mutation rule is posited as follows:

$$\begin{array}{ll} |p| \rightarrow /f/ & \\ |t| \rightarrow /θ/ & [+obs] \rightarrow [+cnt] / \begin{bmatrix} -vcd \\ +asp \end{bmatrix} \\ |k| \rightarrow /x/ & \end{array}$$

At this point, I should stress the regularity with which the voiceless aspirated stops have been treated in the mutation system. Whereas the voiced unaspirated stops do not operate as an entire natural class in the soft mutation and are not even affected by the spirant mutation, the voiceless aspirated stops always operate as a natural class--in rules 1.1.a, 1.2.a (and 1.2.c), and 1.3. As a result of this regularity, the class of voiceless aspirated stops is described within the generative phonological framework with the maximum economy and generality, as each change affects one and only one feature in one natural class, and every mutation affects the class.

1.4 Aspirate Mutation. In Standard Welsh, the aspirate mutation is not commonly considered to be a part of the consonant mutation system, as it does not affect consonants. Under the conditions of aspirate mutation, an initial vowel undergoes preaspiration. In the generative framework, the only way to describe such a phenomenon as preaspiration of an initial vowel is to posit a rule whereby the glottal fricative /h/ is inserted in

initial position, as follows:

$$\emptyset \rightarrow \begin{bmatrix} -\text{voc} \\ -\text{cns} \\ -\text{hgh} \end{bmatrix} / \# \text{ --- } \begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix}$$

Although not in ~~Standard~~ Welsh, as Fynes-Clinton (1913:xviii) points out, the aspirate mutation does in fact affect /m/, /y/, and /w/ in the Bangor dialect.⁷ The extension of aspirate mutation to consonants is treated further in Chapter 7.

1.5 Functionality and Redundancy. As stated in section 1.0, the mutation system of Modern Welsh corresponds roughly to an inflectional system in such languages as Latin. As is true with many inflectional systems, such as that of Latin, the elements of the system can reflect various degrees of functionality and various degrees of redundancy.

The functionality of the soft mutation rules may sometimes be of a relatively low degree. For instance, a sentence may be preceded by a sentence marker fe /ve/ or mi /mi/ (the choice being largely determined by dialect). When this happens, the initial segment of the following verb undergoes soft mutation. Thus, a sentence such as gwelodd ef dad /gweloð ev dad/ 'he saw a father' may optionally be preceded by the indicative sentence marker fe /ve/, in which case, through the soft mutation rule 1.1.c, above, we obtain fe welodd ef dad /ve weloð ef dad/. The functionality of the rule in this case can only be considered minimal, as the sentence conveys exactly the same meaning with or without the addition of the fe /ve/ and its subsequent triggering of the soft mutation rule.

On the other hand, the functionality of the soft mutation may be

of a relatively high degree. For example, a noun which is the direct object of an inflected verb undergoes the soft mutation of its initial consonant. In the sentence gwelodd ef dad /gweloð ev dad/, introduced above, the initial segment of dad /dad/ is derived by way of the soft mutation rule 1.1.a from underlying |t| in tad /tad/ 'father'. Thus, in this sentence the soft mutation functions to designate the direct object.

As far as redundancy is concerned, in the sentence gwelodd ef dad, there is a high degree of redundancy in the soft mutation form of the initial segment in dad /dad/. The information that dad /dad/ is the direct object of the inflected verb is not only conveyed by the soft mutation form, but it is also conveyed by the position of the word in the sentence. On the other hand, if we were to delete the redundant ef /ev/ (redundant because of the third person singular ending on the verb), we would be left with the sentence gwelodd dad /gweloð dad/. In this latter sentence, the soft mutation of the initial segment in dad /dad/ is the only indication that the noun is the direct object of the inflected verb ('he saw a father') rather than the subject of the verb ('a father saw (something)'). Thus, in this latter sentence, the functionality is of a high degree.

Moreover, the third person singular possessive pronouns for masculine and for feminine gender are identical in phonological shape. The only way that the speaker has to tell them apart (other things being equal) is by the fact that the masculine gender governs the soft mutation in such instances and the feminine gender governs the spirant mutation. For example, ei dad /i: dad/ means 'his father', and ei thad /i: θad/ means 'her father'.

Usually, the mutation forms are redundant to some degree. Because not all segments undergo mutation rules (for example, /s/ takes no part in any mutation), it would necessarily have to be the case that some other grammatical means should also be able to convey the information conveyed by mutation. For example, the nasal mutation rules are motivated by the first person singular possessive pronoun. Thus, fy nhad /və nhad/ 'my father' is derived by rule 1.2.a (1.2.c) above. The same grammatical information (that is, first person singular possessive) conveyed by the nasal mutation of the initial segment is also conveyed by the pronoun itself. Now in this case, the pronoun may be deleted, reducing the redundancy of the nasal mutation form. However, when the possessed word does not begin with a segment that undergoes nasal mutation, the pronoun cannot be deleted without the loss of meaning (other things being equal). For example, in fy mam /və mam/ 'my mother', the initial segment of the noun does not undergo nasal mutation. Thus, the pronoun cannot be deleted without losing the information of the first person singular possessive.

In the case of the third person singular possessive pronouns, where both masculine and feminine have the same phonological shape and differ only in their mutations, there are other ways of telling the two pronouns apart when the initial segment of the possessed noun does not undergo either soft or spirant mutation. For example, the noun chwaer /xwa:ɪr/ 'sister' does not undergo any mutation. When this word is possessed by either the third person singular possessive masculine or feminine pronoun, a form of the pronoun follows, as in ei chwaer ef /i: xwa:ɪr ev/ 'his sister' and ei chwaer hi /i: xwa:ɪr hi:/ 'her sister'.

1.6 The Phonology of Mutation. There are two sides to the notion of the Welsh mutation system--a phonological side and a grammatical side. In this chapter, we are only concerned with the phonological considerations inherent in the mutation system.

Phonology, in the generative use of the term, is systematic (morphophonological in the Prague sense). By systematic, I mean that the surface phonological segment (or string of segments) is related in a manner making the fullest possible use of generalization to an underlying segment (or string of segments). Moreover, the manner in which the two levels are related is a dynamic one. That is, processes actively transform the underlying segment into a surface phonological segment.

As we review the mutation rules offered in this chapter, we should be able to see that these rules fulfill the notions of systematicity and dynamism (through process). The surface phonological forms are derived from the underlying segments by processes of lenition (realized through various other processes), nasalization, and frication. These active processes are expressed in terms of phonetic feature changes.

In order to maintain the highest degree of systematicity, it is necessary to strive toward the greatest amount of generalization in the phonological rules consistent with the organization of the phonological system. Herein lies a danger, if we restrict our view only to the phonological side without giving due consideration to the grammatical side of the mutation system.

It is apparent that the process of frication is noted not once but twice in the rules--once in rule 1.1.b and once in rule 1.3. At first glance, it would appear that rule 1.1.b and rule 1.3 should somehow be collapsed into a single rule in order to reflect the fact that

they represent a single dynamic process. If we restrict our view to the phonological considerations of the system, such a notion that the rule 1.1.b in fact represents spirant mutation (because of the frication process) might appear to be justified.

To combine rules 1.1.b and 1.3 into a single rule, however, would be ignoring the second half of the mutation system, the grammatical considerations. As the soft mutation has one set of grammatical contexts and the spirant mutation has a completely different set (as I show in Chapter 2), the two rules cannot be combined without creating a rule of such complexity as to make it unworkable. Moreover, as I demonstrate in section 6.1, the frication process in rule 1.1.b is actually just a notational device through which lenition can be realized. As stated in section 1.1, the soft mutation is a process of lenition that cannot be rendered in one single rule in binary features; rather, it must be rendered through a combination of other, binary features due to the demands placed upon generative phonology. Thus, the frication in rule 1.1.b is just a means to another, more general process, while the frication in rule 1.3 is the ultimate process involved.

NOTES TO CHAPTER 1

¹The terminology used with respect to the mutation system is the traditional terminology used in the field of Welsh linguistics (see, for example, Morris Jones 1913; Jackson 1953; Watkins 1961; etc.). I maintain the traditional terminology in this study because it is clear to those working within the field, and I believe that the creation of new terms for the mutation system would serve no useful purpose. Of course, in the final analysis, the precise term used is only a convenient device for designating a linguistic relationship.

²This practice of using three distinct categories of segment from the underlying to the phonetic segment is established in Schane 1973. As mentioned in section 6.2, this practice is at variance with the system used in Chomsky and Halle 1968 as well as in most other generative theoretical works. According to the system of Schane 1973, the underlying segment (representation) becomes a phonological segment through the application of systematic phonemic rules (or morphophonological rules). The phonological segment created by these systematic phonemic rules then becomes a phonetic segment through the application of systematic phonetic rules (or allophonic rules). Thus, the *t* of *tad* /tad/ 'father' becomes /d/ through the application of a systematic phonemic mutation rule, while the /g/ of *ysgol* /sgol/ 'school' becomes [g] (the voiceless unaspirated dorso-velar stop) through the application of a systematic phonetic rule. The systematic phonetic relationships are dealt with in greater detail in Chapter 7.

³The initial *ph* /f/ in the standard orthography is reserved for the spirant mutation of *p* /p/ only. Elsewhere the sound is rendered in the orthography by the letter *ff*. Thus, the reader, when confronted with an initial *ph* spelled in a word should have some indication that the word is in the environment of the spirant mutation.

⁴Note that this is the phonological position of articulation, not the precise phonetic point of articulation. The fact that the labial stops are bilabial and not labio-dental while the labial fricatives are labio-dental and not bilabial indicates that the two points of articulation are in complementary distribution. Thus, in the phonology, we consider this to be only one position of articulation.

⁵I am assuming implicitly a set of redundancy rules based upon the specifications in Table 1.0.c. These redundancy rules apply with each phonological rule. Thus, for example, if a segment is specified [+continuant], it need not be specified [-nasal] as in the Welsh phonological system, there are no segments which would be both [+continuant] and [+nasal] (no nasal fricatives).

⁶This is shown in the example of phen /fen/ in note 3, above.

⁷According to Mr. Hugh Jones of Bettws Garmon, Gwynedd, the extension of aspirate mutation is found in other districts in North Wales as well.

CHAPTER 2 THE GRAMMAR OF MUTATION

2.0 Grammatical Motivation for Mutation. As stated in section 1.6, there are two sides to the mutation system--the phonological side and the grammatical side. In treating the latter side of mutation, it is necessary to consider the nature of generative phonology as a structurally based method.

In saying that generative phonology is a structurally based system, I mean that the motivation for the application of any phonological rule is based upon notions of structural relationships. These structural relationships are of two types: paradigmatic and syntagmatic (compare de Saussure 1959). The paradigmatic relationship in the mutation system is the various phonological feature changes described in the rules in Chapter 1. These changes in effect reflect the alternation of particular segments.

For example, the lexical item tad |tad| 'father' can undergo rule 1.1.a in order for dad /dad/ to be derived, or it can undergo rule 1.2.a (1.2.c) in order for nhad /_onhad/ to be derived, or it can undergo rule 1.3 in order for thad /θad/ to be derived. Of course, it may not undergo any of these rules, in which case tad /tad/ will be derived. Now the segments /t/, /d/, /_onh/, and /θ/ alternate with one another in what is known as a paradigmatic relationship. As shown below, however, it is not a simple paradigmatic relationship.

A paradigmatic relationship does not exist in a vacuum; it has a

particular context, or environment. If the environment remains constant, then what we have in the environment is a syntagmatic relationship, or syntagm. For example, we can change the initial consonant of the word te /te/ 'tea' such that it acquires voice and loses aspiration. The resulting word is de /de/ 'south', which we recognize as a word with a different meaning from the word te /te/. On the other hand, we could shift the position of articulation of the initial consonant of te /te/ from apico-dental to bilabial, in which case we would have the word pe /pe/ 'if', which we also recognize as a word with a meaning quite different from te /te/. In these cases, only one consonant has been changed, and the consonants involved are in a paradigmatic relationship. The environment of this paradigm, however, has remained constant, -e /e/. This environment is a syntagm. The only things that have changed in this exercise are the phonological segments in initial position and the meaning of the resulting words. The phonological syntagm has not changed.

The Welsh mutation system, however, represents a far more complex set of relationships. When an initial segment of a word changes due to mutation, the environment of the word itself forms the syntagm. But the phonological word is usually the highest point in the grammar at which we can talk of a syntagm for phonological items without introducing grammatical relations. The reason why we cannot include the other words to which the mutated word relates in the syntagm is that the grammatical relationships that obtain between the affected word and the other words of the phrase or clause also change in the course of mutation.

This notion of a syntagm within a grammatically well-formed string of words is crucial to the operation of the mutation system. This can be illustrated with the above-mentioned minimal pairs, te /te/ and de /de/.

A speaker could utter the sentence ble mae'r te? /ble ma:ɪr te/ 'where is the tea?' By changing the initial consonant of te /te/ so that it is voiced and unaspirated, the sentence becomes ble mae'r de /ble ma:ɪr de/ 'where is the south?' Of course, the sentences represent quite different meanings semantically, but the grammatical relationships that hold between the rest of the clause and te /te/ in the first sentence and de /de/ in the second sentence are identical. Thus, in this simple case of paradigmatic and syntagmatic relationships, the entire sentence can act as the syntagm.

On the other hand, when a grammatical paradigm in which /t/ and /d/ alternate in the mutation system is set into a grammatically well-formed string of words, the result is quite different. To illustrate this, I use the example from section 1.5. In the sentence gwelodd tad /gweloð tad/ 'a father saw (something)', the word tad /tad/ is the subject of the sentence. Now if we were to apply rule 1.1.a in order to derive the form dad /dad/, as we have done above, the result would be gwelodd dad /gweloð dad/ 'he saw a father', in which the word dad /dad/ is the direct object of the verb. Thus, the application of the mutation rules does not change the lexical meaning of the word, but it does reflect a change in grammatical relationships.

Because the change in the phonological paradigm in the mutation system actually reflects a change in the grammatical relationships, we do not have a simple set of paradigmatic relationships existing among phonological items. Instead, we have two paradigms which are complexly interrelated--a phonological paradigm and a grammatical paradigm.

In the transformational-generative mode of description, the syntactic component precedes the phonological component (see Chomsky 1965;

Chomsky and Halle 1968). Thus, the grammatical relationships are derived (transformationally) before the phonological rules are applied. In the dynamic and directional process of derivation, then, the particular item in the grammatical paradigm is established and presented to the (interpretive) phonological component. Because a particular grammatical relationship is presented to the phonological component, we apply a particular phonological mutation rule--the rule which corresponds to the grammatical relationship. It can be said, then, that these grammatical relationships form the motivating environment of the mutation rules of Chapter 1.

There are several pertinent considerations in the environment of the mutation rules. First of all, the segment to be affected must be in the proper position in the word--usually initial position. Furthermore, the grammatical environment pertinent to the application of the rule must be present. The grammatical environment consists of two factors. The first of these is the morphological factor. The word must be of a particular class (noun, verb, etc.) and a particular gender and number. The second factor is the syntactic relationships into which the word enters (subject, object, possessed, etc.).

Once all of the pertinent considerations for the application of the mutation rules are met, we can say that the motivation of the application of the rule lies in the environment. If the environment is appropriate and the segment in question is indeed covered by the given mutation rule, then this rule must apply. If, however, any single factor is absent, then the mutation rule cannot apply. Thus, each factor is necessary for mutation to apply, but only the sum of all the factors is sufficient for mutation to apply.

The particular grammatical factors involved in mutation vary from dialect to dialect. As can be seen in Griffen 1974b, even the phonological factors tend to be dependent upon dialect. In Standard Welsh, however, they are fairly consistent. A complete description of them can be found in Morgan 1952 along with pertinent exceptions (counter-examples in the sense of Hjelmslev 1970:30-1) and the historical development of various forms in Modern Welsh. Short but usually adequate summations are often given in textbooks (such as Bowen and Rhys Jones 1960; James 1966; etc.).

In the following sections, I describe the grammatical environments of the various mutation rules. This is only intended to be a short summation in generative terminology. I use the classifications and order of James (1966:41-3) because of its accessibility, organization, and brevity.

2.1 Environment I. Before treating those environments in which a mutation rule does apply, I should first clarify what takes place when the environment of a word does not in fact satisfy the conditions of the mutation rules. When the environment does not meet any of the mutation rules, the underlying segment (the radical) is realized as the phonological segment. Whenever the environment does not specify the application of any mutation, it is termed environment I. To specify the exact description of environment I, as well as the exact description of environments which cause the mutation rules to apply, would be very redundant in the description (compare the practice of Gleason 1961: 101-3).

For example, the personal possessive pronouns motivate the environment

for all mutations in the system. The first person singular possessive pronoun motivates the nasal mutation, the second person singular motivates the soft mutation, the third person masculine also motivates the soft mutation, the third person feminine motivates the spirant mutation and aspirate mutation, and the first and third person plural motivate the aspirate mutation. Now as it happens, the second person plural possessive pronoun has not been specified as being a motivating factor for any of the mutation rules. By its complementary nature, we can therefore assume that environment I obtains and that none of the mutations apply. Thus, the radical is derived as the phonological segment, with no feature changes. So eich tad /eix tad/ 'your (plural) father' does not reflect the application of any mutation rule.

This notion of environment I may appear to be fairly uninteresting at this point, but it proves to be quite crucial. The point that must be remembered is that when no mutation environment exists, the radical is realized. Moreover, this radical, as shown in section 1.0, is to be taken as the underlying form, the segment from which all of the mutation forms are derived.

At first glance, there does appear to be a complication in our handling of the radical as the underlying segment and of environment I as the general environment. This complication centers around the notion of 'hard mutation' (see Watkins 1961:66-7). According to the traditional analysis of the system, hard mutation affects adjectives in such a way that an adjective ending in a voiced unaspirated stop 'hardens' the stop to a voiceless aspirated one when an ending (equative, comparative, or superlative) is added.

Hard mutation appears to have all of the elements of a normal

consonant mutation--a particular phonological class (*mediae*) and grammatical considerations (the class of adjectives and particular endings). For example, the adjective teg /teg/ 'fair' is realized as teced /teked/ in the equative, tecach /tekax/ in the comparative, and tecaf /tekav/ in the superlative. Likewise, tlawd /tlaud/ 'poor' is realized as tloted /tloted/ in the equative, tlotach /tlotax/ in the comparative, and tlotaf /tlotav/ in the superlative. Moreover, gwlyb /gwlib/ 'wet' is realized as gwlyped /gwlepéd/ in the equative, gwlypach /gwlepax/ in the comparative, and gwlypaf /gwlepav/ in the superlative.¹ Thus, the entire natural class of voiced unaspirated stops is affected.

If we were to accept the traditional notion of hard mutation, then we would have to state that in this one case environment I motivates the application of a rule by which the underlying voiced unaspirated stops become realized as voiceless and aspirated. For several reasons, however, I do **not** accept the traditional notion of hard mutation. First of all, while the soft mutation is quite extensive in its range of application, the hard mutation is restricted to this one type of instance. by treating the voiceless aspirated stop as underlying and extending the environment of the soft mutation rules to include segments in final position at least in adjectives, we could simplify the system of rules and simplify our description. Furthermore, as I show in section 5.1, there has been a general historical development whereby the final stop in the Welsh word has become voiced and unaspirated (although, to be sure, voicing in final position is not frequent in languages). Taking this development into account, the soft mutation would normally apply to the final position, anyway, making the application of the soft mutation rule 1.1.a in this case simply a reflection of a much larger

phenomenon. This analysis does not reflect a grammatical environment, and this problem is also discussed in section 5.1.

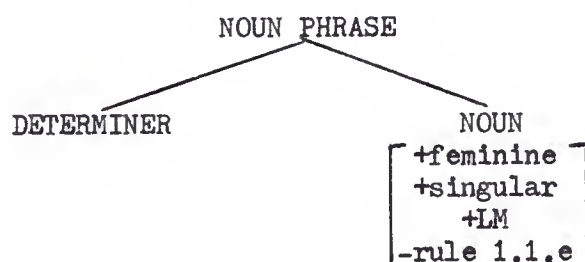
One argument that could be used for the traditional interpretation of the hard mutation is the fact that in Middle Welsh, an /h/ sometimes preceded the adjective ending (see Evans 1960:23-4). This /h/, however, is no longer productive. Although it is an important consideration in an earlier phonology of Welsh, it is not pertinent to Modern Welsh--especially not in a synchronic description of Modern Welsh. I return to this relationship between /h/ and the stops in Chapter 7.

2.2 Environment II. Listed below are the structural descriptions of most environments which, in Standard Welsh, are sufficient for the application of the soft mutation rules. Unless otherwise stated, it is understood that the segment in the critical position for mutation is in fact any one of the affectable segments listed in section 1.1. For each structural description, I first discuss the necessary elements and then form these into the generative model (see, for example, Chomsky 1965; Jacobs and Rosenbaum 1968; R.M. Jones 1963). All descriptions are based upon James (1966:41-3), and full descriptions are found in Morgan 1952. Because of the large number of environments found in environment II, it is usually necessary to list first those which affect nouns (environments IIa-m), then those which affect adjectives (environments IIn-s), those which affect verbs (environments IIt-z), and finally that which affects adverbs (environment IIaa). In any case, the word affected by soft mutation is marked in the formal structural description with the notation [+LM] (for lenis mutation).

- a. Welsh has only one article--the definite article. This is

realized as y /ə/ before words beginning with consonants, yr /ər/ before words beginning with vowels (including the case in which |g| is deleted through soft mutation), and 'r /r/ after words ending in a vowel (regardless of the following word). When any one of these forms of the definite article precedes a noun which is both feminine in gender and singular in number, the initial consonant of the noun is in environment II. However, the environment IIa is only operative for the mutation rules 1.1.a-d--rule 1.1.e (ll /l/ and rh /r/) does not apply in this environment. For example, dafad /davəd/ 'sheep' is a singular feminine noun. When preceded by the definite article y /ə/, the noun phrase is realized as y ddafad /ə δavəd/ 'the sheep'. The rule does not apply, however in the case of llaw /lau/ 'hand', which is realized y llaw /ə lau/ 'the hand'.

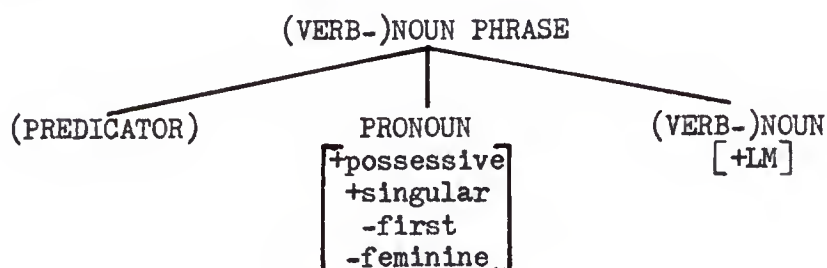
The formal structural description for environment IIa can be rendered as follows:



b. The second person singular familiar possessive pronoun is realized as dy /də/ 'thy' or as 'th /θ/ when it is contracted onto the preceding word ending in a vowel (the actual words with which the pronouns can be contracted are fairly restricted in number). The third person singular masculine possessive pronoun is realized as ei /i:/ 'his' or as the contracted forms 'i /i/ or 'w /u/ (the latter when the preceding word ends in /i/ or /i/). These pronouns always precede

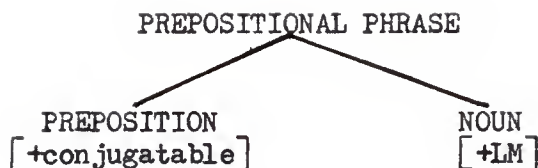
a verb-noun,² which in this case operates in the mutation system as a noun, as the direct object of the verb-noun. The noun or verb-noun is thus in environment IIb, and the initial consonant undergoes any applicable soft mutation rule. For example, tad /tad/ 'father' can be realized as dy dad /dæ dad/ 'thy father' or ei dad /i: dad/ 'his father'. The periphrastic verbal phrase for 'I see him' would be wyf i yn ei weld /u:iv i ɛn i: weld/ with the verb-noun derived from gweld /gweld/ 'to see'.

The formal structural description for environment IIb can be rendered as follows:



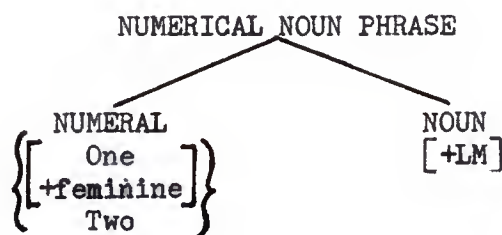
c. Twelve of the more common prepositions are am /am/ 'for', ar /ar/ 'on', at /at/ 'to', gan /gan/ 'with', tros /tros/ 'over', trwy /tru:i/ 'through', wrth /urθ/ 'at', dan /dan/ 'under', heb /heb/ 'without', hyd /hɪd/ 'till', i /i/ 'to', and o /o/ 'from'. These constitute an element of environment IIc. If a noun follows any one of these, the initial consonant of the noun will undergo soft mutation. This group of prepositions, moreover, with two exceptions represents the class of prepositions which are conjugated.³ For example, the preposition ar /ar/ can precede the noun cae /ca:i/ 'field' for the prepositional phrase ar gae /ar ga:i/ 'on a field'.

By marking the exceptions in the lexicon, we can render the above environment as follows:



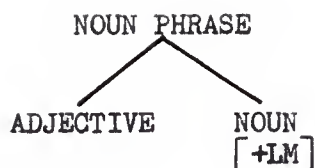
d. A noun phrase can be constructed with a numeral and a noun. The noun in this case is always singular. The noun is in environment IIId, if the numeral is un /ɪn/ 'one' (which precedes both masculine and feminine words) and the noun is feminine in gender or the numeral is either dau /dai/ 'two (masculine)' or dwy /du:ɪ/ 'two (feminine)'. For example, merch /merx/ 'girl' is feminine. 'One girl' would be un ferx /ɪn verx/, and 'two girls' would be dwy ferch /du:ɪ verx/.

The formal structural description for environment IIId can be rendered as follows:



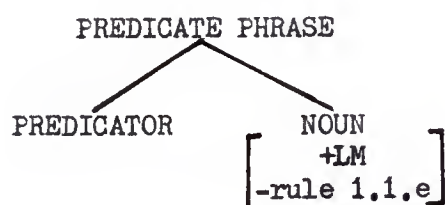
e. Usually, an adjective follows the noun it modifies. Some adjectives, however, regularly precede the noun, and for special emphasis any adjective can precede the noun it modifies. When an adjective does precede the noun, the noun is in environment IIe, and the initial segment is subject to soft mutation. For example, dyn /dɪn/ 'man' usually follows the adjective hen /hen/ 'old', resulting in hen ddyn /hen δɪn/ 'old man'. Compare mab unig /mab ɪnɪg/ 'lonely son (mab)' with unig fab /ɪnɪg vab/ 'only son'.

The formal structural description for environment IIe can be rendered as follows:



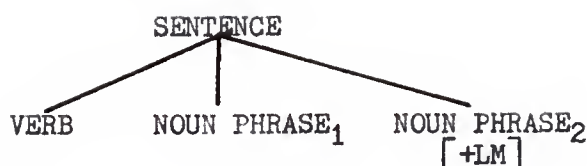
f. A predicate noun in Welsh always follows the predicator yn /ən/. When this occurs, the noun (but not a verb-noun) is in environment II_f, and its initial consonant undergoes soft mutation. For example, Cymro /kəmro/ 'Welshman' undergoes rule 1.1.a in the sentence mae ef yn Gymro /ma:i ev ən gəmro/ 'he is a Welshman'. As in environment II_a, environment II_f does not effect rule 1.1.e.

The formal structural description for environment II_f can be rendered as follows:



g. In Welsh, either an inflected form of the verb may be used or a periphrastic verbal phrase (verb 'to be' + predicator + verb-noun). When the inflected form of the verb is used, any noun which serves as direct object to the verb is in the environment II_g, and its initial consonant undergoes soft mutation. For example, wyf i yn gweld dyn /u:iʋ i ən gweld dɪn/ 'I am seeing a man (dyn)' can be rendered with an inflected verb form as gwelaf ddyn /gwelav δɪn/.

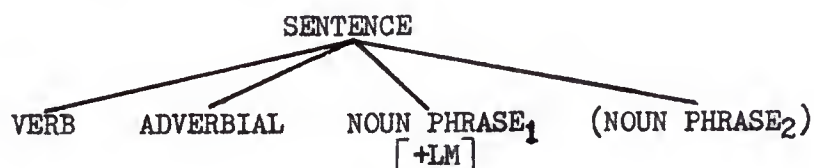
The formal structural description for environment II_g can be rendered as follows:



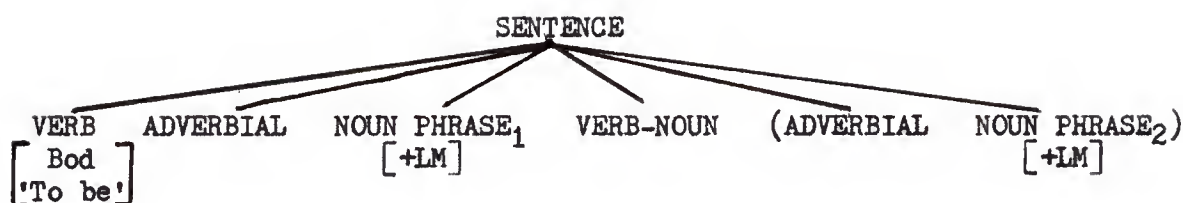
This notation is in accord with R.M. Jones 1963. The second noun phrase in this system is the direct object.

h. Normally, the noun subject follows the verb 'to be' in a periphrastic verbal construction or with an inflected verb, and the noun object follows the verb-noun in a periphrastic verbal construction (see the previous section). Whenever this pattern is interrupted by an adverbial element (for example, a sentential adverb or prepositional phrase), the noun affected is in environment IIh, and its initial consonant undergoes soft mutation. For example, the sentence 'there were people (pobl) there (yno) on vacation' can be rendered without interruption as oedd pobl yn gwylio yno /o:ɪð pobl ɛn gu:ɪlio ɛno/ or with interruption oedd yno pobl yn gwylio /o:ɪð ɛno pobl ɛn gu:ɪlio/.

The formal structural description for environment IIh can be rendered as follows:

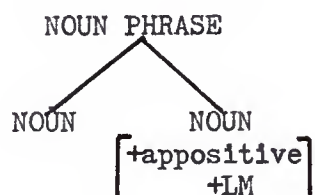


In the case of periphrastic verbal constructions (for example, oedd yno pobl yn dawnsio /oɛð ɛno pobl ɛn daunsio/ 'there were people there dancing'), following R.M. Jones 1963, the following structural description, derived from a transformation, would apply:



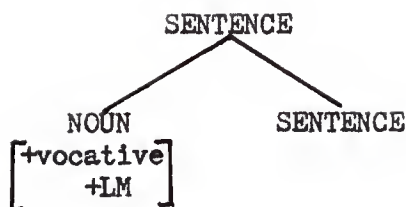
i. When a title or a term in apposition follows a noun, the title is in environment IIIi, and the initial consonant undergoes soft mutation. For example, in the phrase Llewelyn Frenin /leuelin vrenin/ 'Llewelyn the King', brenin /brenin/ 'king' undergoes soft mutation because it is used as a title. In the phrase Llewelyn Fawr /leuelin vaur/ 'Llewelyn the Great', mawr /maur/ undergoes soft mutation even though it is an adjective normally, because it is functioning as a noun in apposition in this phrase. (Compare Llewelyn mawr /leuelin maur/ 'great Llewelyn', in which it is used as an adjective.)

The formal structural description for environment IIIi can be rendered as follows:



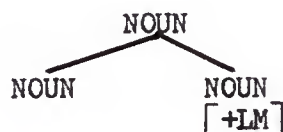
j. The vocative in Welsh is marked such that a noun used in a greeting is in environment IIj, and its initial consonant undergoes soft mutation. For example, the greeting 'O God' is rendered as O Dduw /o ðiɯ/, a soft mutation form of Duw /diɯ/ 'God'.

The formal structural description for environment IIj can be rendered as follows:



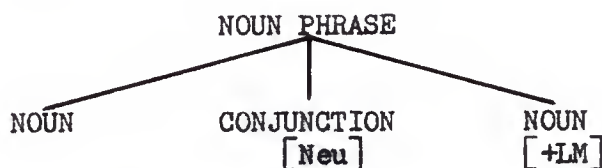
k. Compound words are often formed by joining two nouns into a single noun. When this is done, the second noun-morpheme is in environment IIk, and its initial consonant undergoes soft mutation. (Compare this with environment III, above.) For example, the noun gwaith /gwaio/ 'work' joins with the noun tŷ /ti:/ 'house' in order to produce the noun gweithdy /gweiθdi/ 'workshop'.

The formal structural description for environment IIk can be rendered as follows:



l. When the conjunction neu /nei/ 'or' joins two nouns, the noun following the conjunction is in environment III, and its initial consonant undergoes soft mutation. For example, bachgen /baxgen/ 'boy' and merch /merx/ 'girl' can be joined as bachgen neu ferch /baxgen nei verx/ 'a boy or a girl'.

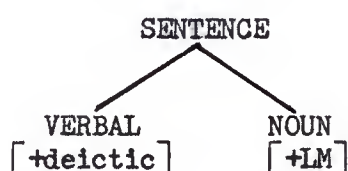
The formal structural description for environment III can be rendered as follows:



m. In Welsh, there are a number of deictic words which function

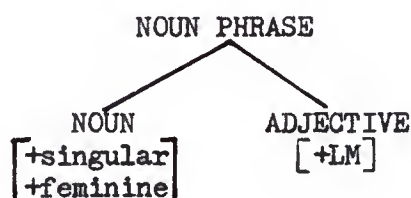
as nonconjugatable verbs. The most common of these are dyna /dəna/ 'here is', dyna /dəna/ 'there is', and dacw /daku/ 'yonder is'. They can be used either in the singular or in the plural. When one of these deictic verbals is used, the noun to which it refers is in the environment II_m, and its initial consonant undergoes soft mutation. For example, llong /log/ 'ship' can be the object of dacw /daku/ to yield the sentence dacw llong /daku log/ 'yonder is a ship'.

The formal structural description for environment II_m can be rendered as follows:



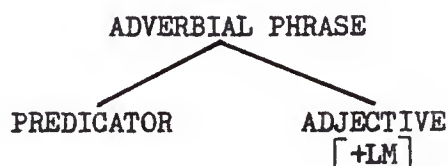
n. As stated in reference to environment II_e, the adjective usually follows the noun it modifies. If the noun is both feminine in gender and singular in number, then the adjective following the noun is in the environment II_n, and its initial consonant undergoes soft mutation.⁴ For example, when da /da/ 'good' follows bachgen /baxgen/ 'boy' the result is bachgen da /baxgen da/ 'a good boy', but when it follows merch /merx/ 'girl' the result is merch dda /merx δa/ 'a good girl'.

The formal structural description for environment II_n can be rendered as follows:



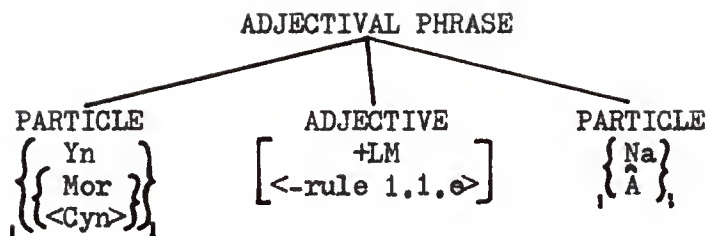
o. An adjective can be used as an adverb by placing it after the predicative yn /ən/. When this is done, the adjective is in the environment IIo, and its initial consonant undergoes soft mutation. For example, the adjective da /da/ means 'good', but the phrase yn dda /ən ða/ means 'well'.

The formal structural description for environment IIo can be rendered as follows:



p. The comparison of adjectives in the equative (as...as) is accomplished in Welsh by placing mor /mor/ before the adjective and â /a:/ after it or by placing cyn /kɪn/ before the adjective and â /a:/ after it. The adjective following either mor /mor/ or cyn /kɪn/ is in the environment IIp, and its initial consonant undergoes soft mutation. The comparison of adjectives in the comparative, moreover, is accomplished by placing yn /ən/ before the adjective and na /na/ after it. The adjective following yn /ən/ is also in environment IIp, and its initial consonant undergoes soft mutation. For example, gwyn /gwin/ 'white' undergoes rule 1.1.c in the phrase mor wyn a'r eira /mor win a:r əira/ 'as white as snow'. However, when the adjective is preceded by cyn, rule 1.1.e (ll /l/ and rh /r/) is not effected.

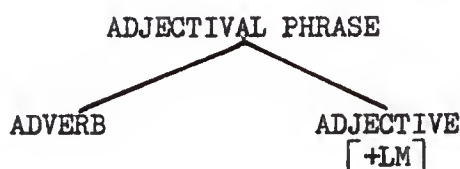
The formal structural description for environment IIp can be rendered as follows:



The angled brackets (< >) can be read 'only if cyn /kɪn/ is used, the rule will not effect rule 1.1.e'.

q. There are certain adverbs that often precede and modify adjectives. These include rhy /ɾi/ 'too', pur /pɪr/ 'pure', lled /led/ 'almost', gweddol /gweðol/ 'fairly', go /go/ 'quite', and hollol /holol/ 'completely'. Whenever one of these adverbs precedes an adjective, the adjective is in environment IIq, and its initial consonant undergoes soft mutation. For example, tenau /tenai/ 'thin' can be preceded by rhy /ɾi/, and the resulting phrase is rhy denau /ɾi denai/ 'too thin'.

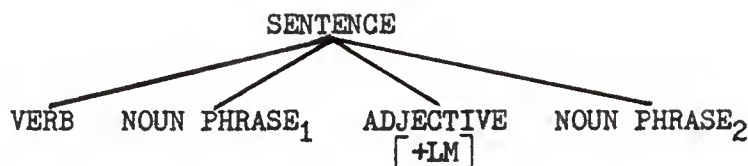
These adverbs can be marked in the lexicon, and the formal structural description for environment IIq rendered as follows:



r. As we see in environment IIg, when a noun is the direct object of an inflected verb, its initial consonant undergoes soft mutation. If an adjective precedes the noun, it is in environment IIr, and its initial consonant undergoes soft mutation.⁵ For example, the periphrastic construction wyf i wedi clywed rhyw ŵr /u:ɪv i wedi klywed ɾiu u:r/ 'I heard some (rhyw) man' can be rendered with the inflected verb

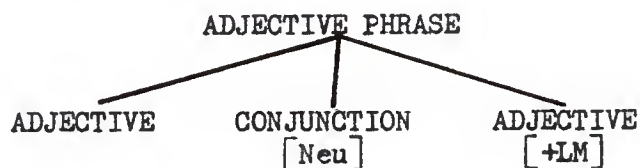
as cluwais ryw ŵr /kliuais rɪu u:r/.

The formal structural description for environment IIr can be rendered as follows:



s. In environment III, we see that when two nouns are conjoined by neu /nei/ 'or', the noun following the conjunction is in environment III. When two adjectives are conjoined by neu /nei/, the second adjective is in environment IIs, and its initial consonant undergoes soft mutation. For example, when gwyn /gwin/ 'white' is conjoined with du /di/ 'black' by neu /nei/, the result is gwyn neu ddu /gwin nei ði/ 'white or black'.

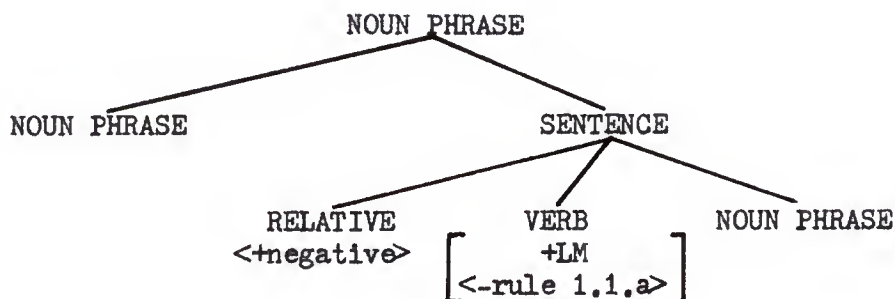
The formal structural description for environment IIs can be rendered as follows:



t. When the inflected form of the verb is used in a relative clause, the relative pronoun (either subject or object) is realized as a /a/ in the affirmative and na /na/ in the negative. The inflected form of the verb must follow the relative pronoun, and the verb is in the environment IIIt, its initial consonant undergoing soft mutation. For example, we find the phrase y bachgen na welodd y ffair /ə baxgen na weloð ə fair/ 'the boy who did not see (gwelodd) the fair'. When

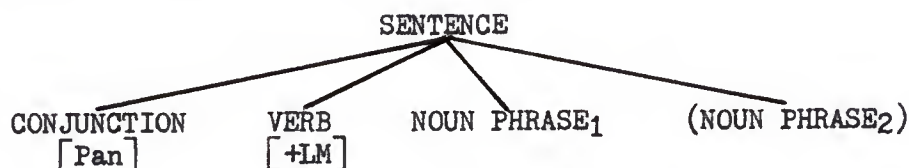
na /na/, the negative relative pronoun, is used, this rule does not effect rule 1.1.a (p /p/, t /t/, c /k/) (see environment IVf).

The formal structural description for environment II_t can be rendered as follows:



u. The conjunction pan /pan/ 'when' always precedes the verb. When it is used, the verb following pan /pan/ is in the environment II_u, and its initial consonant undergoes soft mutation. For example, there is a phrase pan ddeuthum /pan ðəiθɪm/ 'when I came (deuthum)'.

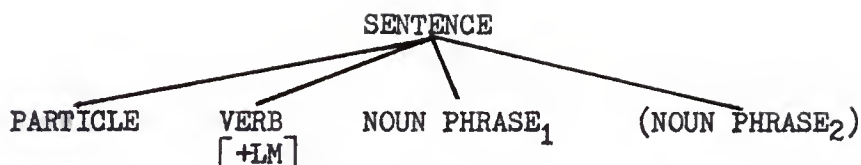
The formal structural description for environment II_u can be rendered as follows:



v. There are several sentential affirmative particles that may optionally introduce the sentence. These precede the verb and include fe /ve/, mi /mi/, and ti /ti/. When these are used, the verb is in environment II_v, and its initial consonant undergoes soft mutation. For example, the sentence cefaiss i afal /kevais i aval/ 'I got an apple' can alternatively be realized as fe gefaiss i afal /ve gevais i aval/.

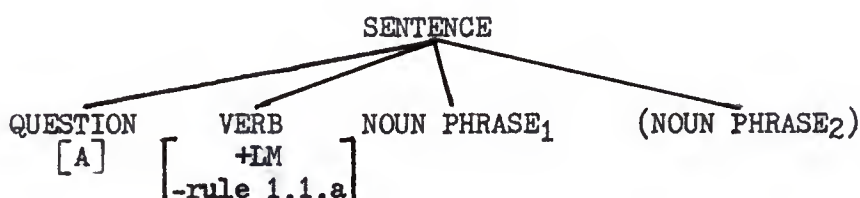
The formal structural description for environment II_v can be

rendered as follows:



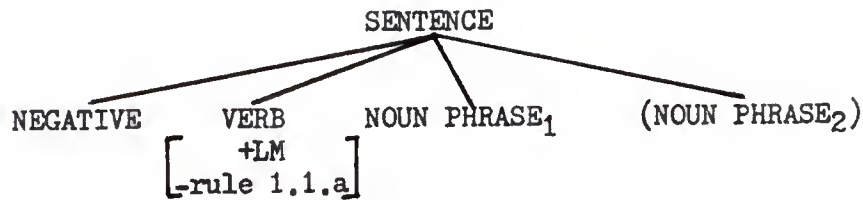
w. The usual way of asking a question is by placing the interrogative a /a/ in front of the sentence. In this position, it precedes the verb, which is in environment IIw, and the initial consonant of the verb undergoes soft mutation. For example, the sentence llwyddodd ef /lu:ɪðoð ev/ 'he succeeded' can be turned into a question with a /a/, a llwyddodd ef? /a lu:ɪðoð ev/ 'did he succeed?' The environment IIw is not sufficient to effect rule 1.1.a (p /p/, t /t/, c /k/).

The formal structural description for environment IIw can be rendered as follows:



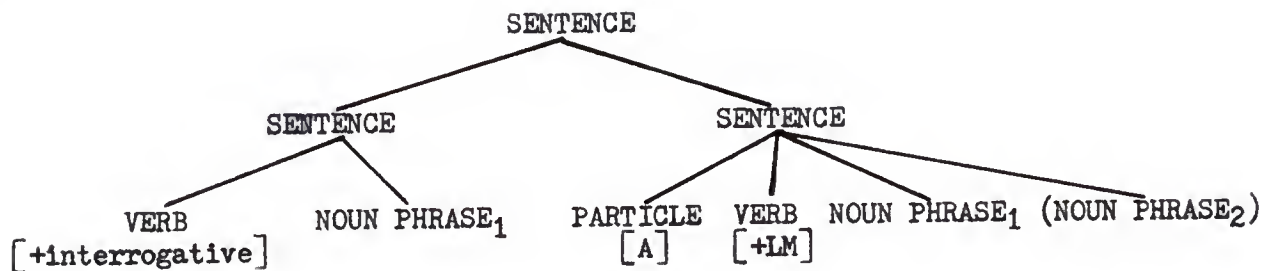
x. Sentences are rendered in the negative by placing a negative word at the beginning of the sentence, such as ni /ni/, na /na/, and oni /oni/ (negative interrogative). The verb which follows such a negative is in environment IIx, and its initial consonant undergoes soft mutation. For example, daeth y bws /da:ɪθ ə bus/ 'the bus came' is negated as ni ddaeth y bws /ni ða:ɪθ ə bus/ 'the bus did not come'. Environment IIx is not sufficient to effect rule 1.1.a (p /p/, t /t/, c /k/) (see environment IVd).

The formal structural description for environment IIx can be rendered as follows:



y. An indirect question is introduced by the particle a /a/. The verb form following the particle is in environment IIy, and its initial consonant undergoes soft mutation. For example, we find the sentence gofyn a gyrhaeddodd hi /govin a gerha:ĩðoð hi/ 'he asks whether she has arrived (cyrhaeddodd)'.

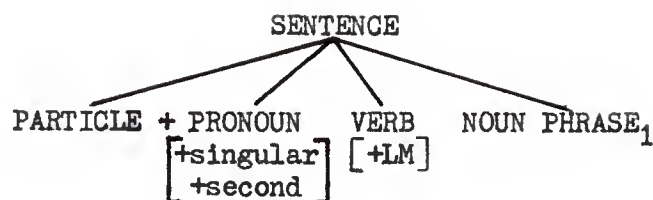
The formal structural description for environment IIy can be rendered as follows:



z. The contracted form of the possessive pronoun can be infixed between the affirmative sentential particle (see environment IIv) and the verb. As such, it functions as the pronominal direct object. When this pronoun is that of the second person singular (familiar), the following form of the verb is in environment IIz, and its initial consonant undergoes soft mutation. For example, there is the sentence fe'th welais /veð welais/ 'I saw (gwelais) thee'.

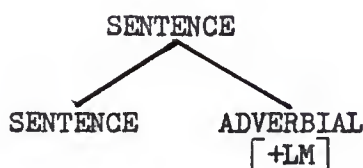
The formal structural description for environment IIz can be

rendered as follows:



aa. Any sentential adverb or adverbial phrase is in environment IIaa, and its initial consonant undergoes soft mutation. This applies no matter where in the sentence it may appear. For example, we have the sentence gwelais ef ddoe /gwelais ev ðo:ɨ/ 'I saw him yesterday (doe)'.
(doe)'.

The formal structural description for environment IIaa can be rendered as follows:

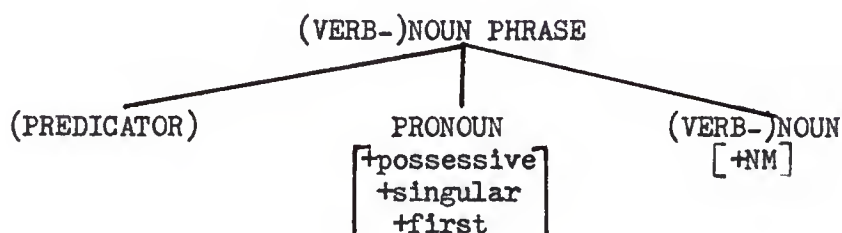


2.3 Environment III. The following is a list of the structural descriptions of most environments which are sufficient for the application of the nasal mutation rules in Standard Welsh. As with the soft mutation, I adhere to the list and order found in James (1966:41-3), the full descriptions for which are found in Morgan 1952. The word affected by nasal mutation is marked in the formal structural description with the notation [+NM].

a. The first person singular possessive pronoun in Standard Welsh is fy /və/ 'my'.⁶ The noun which follows this pronoun is in the environment IIIa, and its initial consonant undergoes nasal mutation. For

example, cartref /kartrev/ 'home' when possessed by the first person singular pronoun is realized as fy nghartref /və ɲhartrev/ 'my home'.

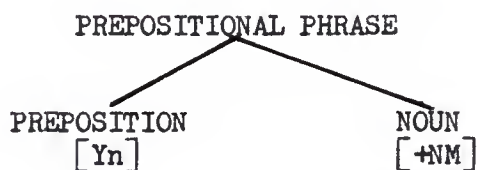
The formal structural description for environment IIIa can be rendered as follows:



As in environment IIb, the pronoun can also precede the verb-noun in the periphrastic verbal construction, as in the sentence mae ef yn fy ngweld /ma:i ev ən və ɲweld/ 'he sees (gweld) me'. In this case, the first person singular possessive pronoun functions as the direct object.

b. In Standard Welsh, there is a preposition yn /ən/ 'in'. When this preposition precedes a noun, the noun is in environment IIIb, and its initial consonant undergoes nasal mutation. For example, 'Wales' is Cymru /kəmri/, but 'in Wales' is yng Nghymru /əɲ ɲəmri/. As can be seen from this example, the preposition is actually /əN/, where /N/ is an archiphoneme in which position of articulation is predictable and takes on the value of the following consonant or /n/ (see Griffen 1974a).

The formal structural description for environment IIIb can be rendered as follows:



c. In reckoning time, there are three words of particular importance--

blwydd /blu:ɪð/ 'year (of age)', blynedd /bləneð/ 'year', and diwrnod /diurnod/ 'day'. As stated in section 2.2.d, when a noun follows a numeral it is realized in the singular. When any of these three nouns follows pum /pɪm/ 'five', saith /saiθ/ 'seven', wyth /u:ɪθ/ 'eight', naw /nau/ 'nine', deg /deg/ 'ten', deuddeg /dɛɪðeg/ 'twelve', pymtheg /pəmθeg/ 'fifteen', deunaw /dɛɪnau/ 'eighteen', ugain /ɪgain/ 'twenty', or can /kan/ 'hundred', it is in the environment IIc and its initial consonant undergoes nasal mutation. For example, 'seven years' is saith mlynedd /saiθ mləneð/, and 'eight days' is wyth niwrnod /u:ɪθ niurnod/.

The formal structural description for environment IIIc can be rendered as follows:

NUMERICAL NOUN PHRASE

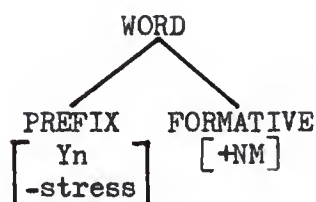
NUMERAL	NOUN
Pum	Blwydd
Saith	Blynedd
Wyth	Diwrnod
Naw	+NM
Deg	
Deuddeg	
Pymtheg	
Deunaw	
Ugain	
Can	

Those numbers not listed in the description either cause no mutation or cause soft mutation (environment IIId) or spirant mutation (environment IVa).

d. There is a morpheme prefix yn- /ən/, not to be confused with the preposition of the same phonological shape, which has various meanings depending upon the word to which it is prefixed. When the prefix is unstressed, the word to which it is prefixed is in environment IIIId, and its initial consonant undergoes nasal mutation. Examples

are found in ynghylch /əŋhɪlx/ 'about' (from yn /ən/ plus cylch /kɪlx/ 'circle'), ymhle /əɪhle/ 'in what place' (from yn /ən/ plus ple /ple/ 'place'), and ynghyd /əŋhɪd/ 'together' (from yn /ən/ plus /kɪd/ 'junction').

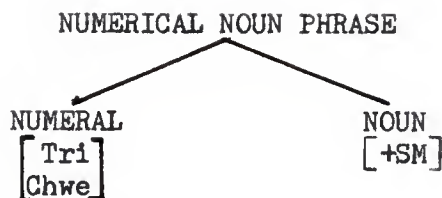
The formal structural description for environment IIId can be rendered as follows:



2.4 Environment IV. Below are the structural descriptions of most environments which are sufficient for the application of the spirant mutation rule in Standard Welsh. Again, I adhere to the list and order found in James (1966:41-3), the full descriptions for which are in Morgan 1952. The word affected by spirant mutation is marked in the formal structural description with the notation [+SM].

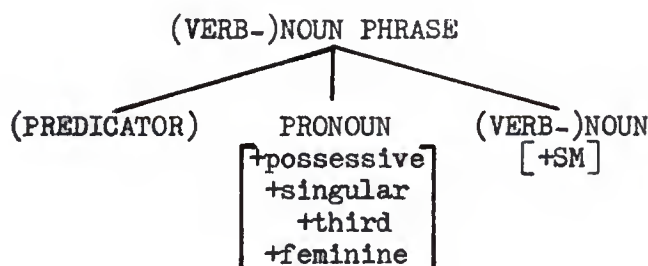
a. As in sections 2.2.d (environment IIId) and 2.3.c (environment IIIc), when a numeral precedes a noun, the noun is realized in the singular. Now if the numeral preceding the noun is either tri /tri/ 'three' or chwe /xwe/ 'six', then the noun following the numeral is in environment IVa, and its initial consonant undergoes spirant mutation. For example, when the word ceffyl /kefɪl/ 'horse' is preceded by chwe /xwe/, the resulting phrase is chwe cheffyl /xwe xefɪl/ 'six horses'.

The formal structural description for environment IVa can be rendered as follows:



b. The third person singular feminine possessive pronoun is ei /i:/ 'her'. It can also be realized as the contracted forms 'i /i/ and 'w /u/, the latter when the preceding word ends in /i/ or /ɪ/. As in section 2.2.b (environment IIb), the contracted forms, identical with the masculine (as is the neutral form), can be added to the end of a few words ending in vowels. When any form of the third person singular feminine possessive pronoun precedes a noun, the noun is in environment IVb, and its initial consonant undergoes spirant mutation. As with all possessive pronouns, these can precede the verb-noun of a periphrastic construction and operate as the direct object of the verb-noun, in which case the verb-noun is also in environment IVb. For example, pen /pen/ means 'head', and ei phen /i: fen/ is 'her head'. Likewise, we find the sentence wyf i wedi ei chlywed /u:ɪv i wedi i: xliued/ 'I heard (clywed) her'.

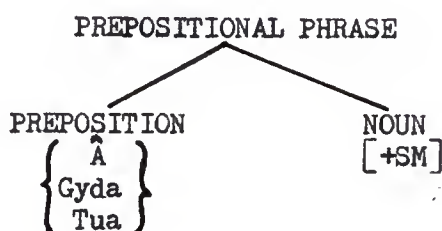
The formal structural description for environment IVa can be rendered as follows:



c. Three prepositions often found in Standard Welsh are â /a:/ 'with', gyda /gɛda/ 'along with', and tua /tɪa/ 'towards'. Whenever

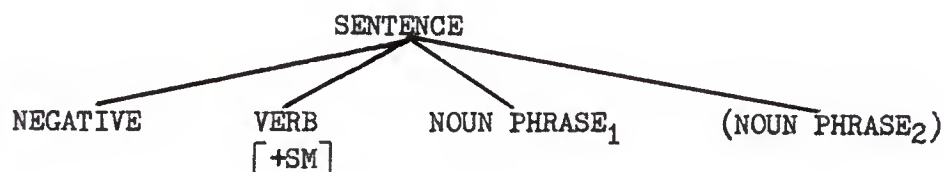
one of these prepositions precedes a noun, the noun is in environment IVc, and its initial consonant undergoes spirant mutation. For example, we find the phrase gyda chyfeillion /geda xevëillion/ 'along with friends (cyfeillion)'.

The formal structural description for environment IVc can be rendered as follows:



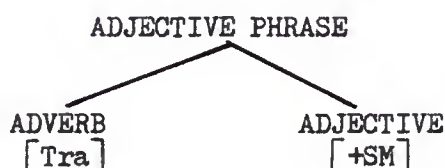
d. It was pointed out in section 2.2,x (environment IIx) that sentences are negated by preceding them with negative markers including ni /ni/, na /na/, and oni /oni/ (negative interrogative). Although environment IIx does not affect the voiceless aspirated stops, environment IVd does. Thus, the verb form following a negative in the sentence is in the environment IVd, and its initial consonant undergoes spirant mutation. For example, there is the question oni thalodd hi?/oni 0aloð hi/ 'did she not pay (thalodd)?' I address the peculiarities of the environments as regards environment II and environment IV in section 2.6.

The formal structural description for environment IVd can be rendered as follows:



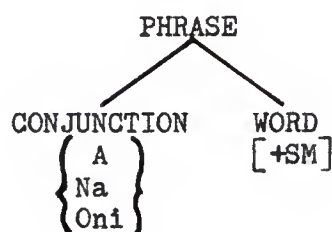
e. As pointed out in section 2.2.q (environment IIq), some adverbs marked in the lexicon cause a following modified adjective to undergo soft mutation. In the case of tra /tra/ 'very', however, the following adjective is in environment IVe, and its initial consonant undergoes spirant mutation. For example, caredig /karedig/ 'dear' can be preceded by tra /tra/ to yield the phrase tra charedig /tra xaredig/ 'very dear'.⁷

The formal structural description for environment IVe can be rendered as follows:



f. The three most common sentence conjunctions are a /a/ 'and', na /na/ 'nor', and oni /oni/ 'until' (not to be confused with the negative interrogative). Any word following one of these conjunctions, whether noun or verb, is in environment IVf, and its initial consonant undergoes spirant mutation. For example, we find ci a chath /ci a xaθ/ 'a dog and a cat (cath)', and oni chyrhaeddodd y trên /oni xərha:ɪðoð ə tre:n/ 'until (unless) he caught (cyrhaeddodd) the train'.

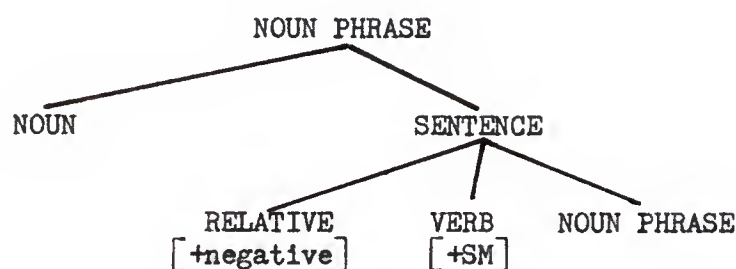
The formal structural description for environment IVf can be rendered as follows:



g. As shown in section 2.2.t, the negative form of the relative

pronoun na /na/ is not sufficient to effect rule 1.1.a in environment IIIt. However, when the negative relative pronoun precedes a form of the verb, the verb is in environment IVg, and its initial consonant undergoes spirant mutation. For example, there is the sentence dyma'r gŵr na chafodd arian /dɛmar gu:r na xavoð arian/ 'here is the man who did not get (cafodd) money'. As in section 2.4.d, I return to the matter of the apparent conflict in environments in section 2.6.

The formal structural description for environment IVg can be rendered as follows:



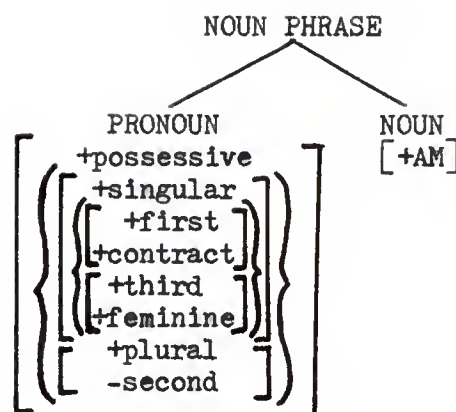
Before leaving the spirant mutation (environment IV), I should like to address the matter brought out in section 1.6. Now that the environments for the soft mutation and the spirant mutation have been examined, it should be fairly obvious why we cannot combine the $|b| \rightarrow /v/$ and $|d| \rightarrow /ð/$ rule (1.1.b) with rule 1.3, in spite of the fact that $/v/$ and $/ð/$ are, after all, spirants, or fricatives. If we were to combine rules 1.1.b and 1.3, we would have to mark twenty-five environments (considering that two overlap) so that part of the spirant mutation rule could apply and part could not, and we would have to mark five more environments so that the latter part could apply and the former part could not. This would make it virtually impossible to combine the two phonological rules.

2.5 Environment V. The final environment that concerns us is the environment which motivates rule 1.4, the aspirate mutation. As pointed out in section 1.4, the aspirate mutation is not exactly a part of the consonant mutation system, as it does not affect consonants (at least in Standard Welsh), though it does affect initial position. Nonetheless, the same considerations affect the environment of aspirate mutation as affect the environments of the various consonant mutations.

Although James 1966 does not list aspirate mutation among the consonant mutations, Bowen and Rhys Jones (1960:167) does list it, and Morgan 1952 also treats it. The word affected by aspirate mutation in the formal structural description is marked [+AM].

The one environment involved in aspirate mutation has to do with the possessive pronouns. When the noun or the verb-noun (in the case of periphrastic verbal constructions) follows the first person singular possessive pronoun contraction 'm /m/ 'my', the third person singular feminine possessive pronoun ei /i:/ or its contractions 'i /i/ or 'w /u/ 'her', the first person plural possessive pronoun ein /əin/ or its contraction 'n /n/ 'our', or the third person plural possessive pronoun eu /əi/ or its contractions 'u /i/ or 'w /u/ 'their', then the noun is in environment V, and its initial vowel undergoes aspirate mutation. For example, 'name' is enw /enu/, and 'her name' is ei henw /i: henu/.

The formal structural description for environment V can be rendered as follows:



2.6 Overlapping Environments. In section 2.2,t we find that the negative relative pronoun is not sufficient to effect rule 1.1.a, and in section 2.2,x we find that the same is true of all negative sentence markers. By using notation, we can describe the phenomenon in which rule 1.1.a is excluded from the environments while rules 1.1.b-e are included.

As we shift our attention to sections 2.4,d and 2.4,g, we see that the spirant mutation is effected in precisely those environments in which the negative relative pronoun and negative sentence markers are found. Thus, it would appear that environments IIIt and IIx overlap with environments IVg and IVd. That is to say that the grammatical specifications are identical.

The notational device which we can use in order to determine when one mutation applies and when the other applies is known as rule ordering. In the generative approach to grammar, the surface (real) level is derived by rules from the deep (abstract) level. Each rule application creates its own intermediate stage with its own item, upon which further processes work in order to derive the ultimate surface forms. These rules must, then, apply in a particular order, and the order used is determined by the generality of one particular order over

another (for examples of such rule ordering, see S. Anderson 1969; Koutsoudas, Sanders, and Noll 1974).

If, once all environments are established, we order the soft mutation rules first, then, in accordance with the [-rule 1.1.a] notation in environments II_t and II_x, we must make sure that the soft mutation rule 1.1.a is not effected. So long as the voiceless aspirated stops do not undergo rule 1.1.a in environments II_t or II_x, then they will be present for the application of rule 1.3 in environments IV_g or IV_d.

On the other hand, if we were to order the spirant mutation rule before the soft mutation rules, then the spirant mutation rule 1.3 would eliminate all occurrences of the voiceless aspirated stops in environments IV_g and IV_d. Once the voiceless aspirated stops in environments IV_g and IV_d are eliminated, there is no reason for specifying in the environments II_t and II_x that the soft mutation rule 1.1.a is not effected, for there are no longer any segments which the rule can affect. Thus, we can allow rule 1.1.a to apply, as it applies vacuously.

For example, we can consider the two sentences dyma'r dyn na chlywais /dɛmar dɪn na xliuais/ 'here is the man whom I did not hear' and dyma'r dyn na welais /dɛmar dɪn na welais/ 'here is the man whom I did not see'. The verb in the first relative clause is chlywais /kliwais/, and that in the second is gwelais /gwelais/. As it stands now, environments II_t and II_x are specified in such a way as to prohibit the underlying |k| from undergoing rule 1.1.a and deriving an inadmissible */gliuais/. If, however, we apply the spirant mutation first, the underlying |k| is rewritten /x/, to yield the correct form /xliuais/. If the spirant mutation applies first, nothing happens to the underlying |g| of /gwelais/, as rule 1.3 only applies to voiceless aspirated stops. If

we apply the soft mutation rules now, there is no /k/ upon which rule 1.1.a can act, and so there is no reason to specify that 1.1.a does not apply. Thus, the spirant mutation 'bleeds' (see Kiparsky 1968) the environment of the soft mutation rules.

In this manner, the overlapping of environments can lead to a more economical description. By taking the bleeding relationship into account, we can reduce the specification in environments II_t and II_x, yielding simpler rules.

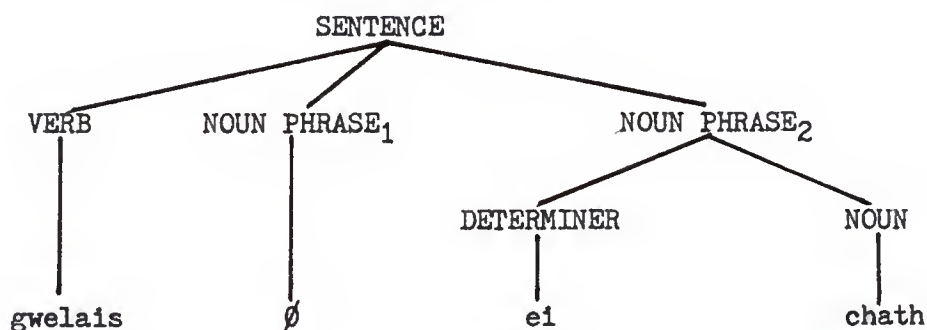
Moreover, we now find that environment II_t is identical to environment IV_g and environment II_x is identical to environment IV_d, except for the marking of the particular mutation. Thus, the two pairs can be combined with the mutation markings in braces. Of course, [+SM] must be entered above [+LM], as spirant mutation must precede soft mutation. We can refer, then, to such overlapping environments with the notation 'environment IV/II'.

2.7 Constituent Environments. A close examination of the environments put forth in this chapter should reveal some potential conflicts. For example, in environment IV_a, we see that a noun possessed by the third person singular feminine possessive pronoun is in a spirant mutation environment. Moreover, in environment II_g, we see that a noun which functions as the direct object of an inflected verb is in a soft mutation environment. What happens if the noun functioning as the direct object of an inflected verb (environment II_g) happens to be preceded by the third person singular possessive pronoun (environment IV_a)?

Let us take, for example, the word cath /kaθ/ 'cat' with an underlying initial [k]. The initial segment undergoes rule 1.1.a in

the sentence gwelais gath /gwelais gaθ/ 'I saw a cat', and it undergoes rule 1.3 in the phrase ei chath /i: xaθ/ 'her cat'. When the phrase is embedded within the sentence, the result is gwelais ei chath /gwelais i: xaθ/ 'I saw her cat', in which the spirant mutation prevails. This is not a situation, as we find in the previous section, in which the more restricted environment applies first, for we can also find the phrase ei hen gath /i: hen gaθ/ 'her old cat', in which environments IIe and IVa conflict and environment IIe prevails.

The choice of which environment prevails is dependent upon the immediate constituents of the sentence (as adapted from Wells 1947; Postal 1964; etc.). An immediate constituent analysis of the above example would yield the following tree diagram:

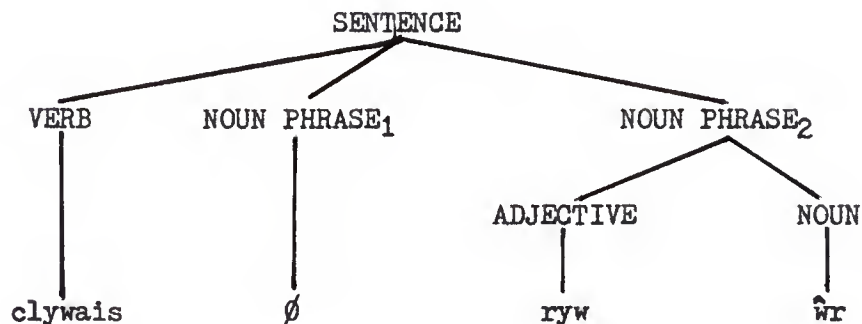


Under NOUN PHRASE₂, NOUN is an immediate constituent of DETERMINER, and the entire NOUN PHRASE₂ is an immediate constituent of VERB under SENTENCE.

Thus, we can form a generalization as to the application of the various environments. A word can only be affected by the environment of its immediate constituency. This forms an important element in the description of the mutation system, for it limits the effective range of dominance of the mutation rules.

An interesting example of this phenomenon is found in section

2.2.r. In the sentence clywais ryw gŵr /kliuais riu u:r/ 'I heard some man', an immediate constituent analysis yields the following tree diagram:



As I point out in section 2.2.r, gŵr /gu:r/ 'man' undergoes soft mutation because of environment IIe. Now if a noun had been the only element of NOUN PHRASE₂, the noun would have undergone soft mutation because of environment IIg. Taking this into consideration, we can say that environment IIr is merely a subset of environment IIg, which should read as follows: 'When the inflected form of the verb is used, any noun phrase which serves as direct object to the verb is in the environment IIg.' Accordingly, the initial segment of the entire phrase (if it is one of the affectable segments as shown in section 1.1) undergoes soft mutation.

Such a revision contains a further generalization which serves to lend a greater economy to the description. The mutation environments do not affect words, as such; rather, they affect entire constituents. The rules, then, do not apply to individual words that occur in the environment, but to the initial segment of the constituent.

The notion that the rules apply to constituents and not to individual words is supported by the treatment of words in series. According to Morgan (1952:182), when a series of words occurs in a mutation environment,

only the first word undergoes the mutation. In Morgan's example, there are three verb-nouns, canu /kani/ 'sing', dawnsio /daunsio/ 'dance', and rhedeg /redeg/ 'run', in a series in the sentence gallaf ganu, dawnsio, rhedeg /galav gani daunsio redeg/ 'I can sing, dance, run'. As the entire noun phrase, which includes the three verb-nouns, is in environment IIg, the initial consonant of the entire phrase undergoes soft mutation.

The relationship of environment I as a real environment can be seen in this phenomenon of embedded constituencies. In the sentence gwelais y dyn /gwelais ə din/ 'I saw the man', the fact that the definite article preceding a masculine noun constitutes an occurrence of environment I determines that no mutation can be effected. This lack of mutation cannot be reversed, no matter what mutating environment the word may enter at a higher level of constituency.

In the generative framework, the constituency relationships shown in the application of mutation environments can be adequately handled through the transformational cycle (see Fillmore 1963). By cyclical application of rules, environments of embedded structures are established and rules applied, before the environments of the embedding structures are established. The mutation rules of Modern Welsh, then, undergo cyclical application.

2.8 The Totality of the Environments. As stated in section 2.0, the mutation environments are both necessary and sufficient for the application of the mutation rules on affectable segments, as outlined in Chapter 1. In the generative framework, these environments are established before the application of the rules. Thus, the environments have a

decisive effect upon the segments which undergo mutation, but the segments have no effect whatever upon the establishment of the environments.

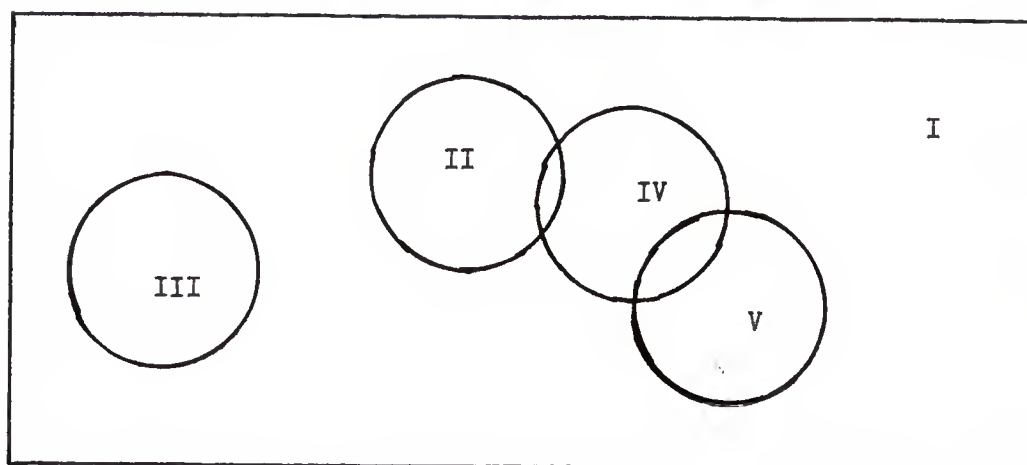
For example, in environment IV, the underlying initial segment |t| is realized as /θ/, as in the word thad /θad/ 'father (spirant mutation form)'. The realization of underlying |t| as /θ/, moreover, is a clear indication on the surface that the affected word is in environment IV. If, on the other hand, we place the word mam /mam/ 'mother' in the same environment, the underlying |m| is realized /m/, giving us no outward indication (phonologically) that the word is in environment IV. Just because the result gives no outward phonological indication of environment IV, however, is no reason to suppose that environment IV is not present. Environment IV and all environments are syntagms which exist, in the generative model, prior to any phonological considerations.

This point is particularly crucial to the description of the consonant shift and to the arguments presented in the next chapter. Each and every initial segment in the Welsh sentence is under one of the five environments at all times. These environments are the motivation for the realization of the underlying segments as surface (or intermediate) segments, and each environment may cause some segments to be changed and other segments to be realized in the radical form. Whether or not we see any change in the phonological specifications of a segment, the environment is present.

The notion that every initial segment (at least) is in one environment at any one time can be graphically illustrated as in Table 2.8. Environments II, III, IV, and V are specified in the grammar and occupy a restricted place in the universe. Environments II and IV overlap

(see section 2.7), as do environments IV and V (see sections 2.4.b and 2.5). The rest of the universe is occupied by environment I. Environment I is, then, limitless, so that any grammatical string which does not meet the specifications of environments II, III, IV, or V must be included in environment I. There are no possible grammatical strings which exist outside the universe.

Table 2.8
Distribution of Mutation Environments



NOTES TO CHAPTER 2

¹I am using here phonological segments which are reflected fairly closely in the standard orthography. Although w is written in the orthography, it is not a separate segmental 'sound' but is realized as rounding throughout the initial cluster of the word.

²The verb-noun in Welsh has no English equivalent. It functions in many ways as a nonfinite form of the verb, but it enters into grammatical relationships as a noun. For example, in the periphrastic verbal construction, in conjunction with the predicator yn /ən/ it is roughly equivalent to the English participle in the English periphrastic verbal construction, but when the object is a pronoun, the verb-noun is 'possessed' by the pronoun in the same manner in which a noun is possessed.

³The exceptions are hyd /hid/, which (as cited) belongs to that class of prepositions governing the soft mutation but does not undergo a conjugation, and rhwng /ɾun/ 'between', which does not belong to the class of prepositions governing the soft mutation but does undergo a conjugation.

⁴There are, however, some exceptions. Chief among these are adjectives following the feminine noun nos /nos/ 'night'. These adjectives do not undergo mutation. Hence, we find the phrase nos da /nos da/ 'good night' (rather than *nos dda */nos ða/), in which the adjective does not undergo soft mutation. For a more complete discussion of such phenomena, see section 3.0.

⁵Note that in this case, the noun follows the adjective in environment IIe. This special type of relationship is treated further in section 2.7.

⁶As is the case throughout the language, there are several dialect variants in use in different parts of Wales. For some examples of some of these, see R.O. Jones 1971.

⁷At this point, I deviate from the order presented in James (1966:43). I do this in order to separate tra /tra/ from the negatives, as together they do not really constitute a single grammatical environment.

⁸Again, as in section 2.2.b and section 2.3.b, the contracted form of the possessive pronoun is added onto the vowel ending in a limited number of words. Compare the distribution of 'w /u/ as a

third person singular feminine possessive pronoun contraction and as a third person plural possessive pronoun contraction with the distribution of the masculine pronoun contraction in 2.2.b and the feminine pronoun contraction governing the spirant mutation in 2.3.b.

CHAPTER 3 THE DEVIATION--SYNCHRONIC ANALYSIS

3.0 Exceptions and Counter-Examples. The environments which I posit in Chapter 2 for the various mutation rules include the most common of the mutation environments. The few which remain, however, do not constitute any particular problem for the description and can simply be added to the list (compare, for example, Evans and Thomas 1968:451-2; Morgan 1952). There are no additional environments which can cause any discrepancies in the relationship which holds between the phonological side and the grammatical side of Welsh mutation.

Notwithstanding the fact that no particular problems would be generated by the addition of other environments, there are indeed some problems which exist within the environments themselves. Most of these problems can be treated as belonging to one of two classifications--exceptions and counter-examples (in the manner they are used in Hjelmslev 1970:30-1).

When a word would 'normally' form part of a mutation environment, either as a conditioning element or the item to be affected, and the mutation rule is not applied because of some arbitrary and idiosyncratic nature of this word, then the word is an exception to the mutation. In order for this to be a true exception, the fact that the word does not undergo mutation cannot be predicted from any morphological or syntactic (or, indeed, semantic) class to which the word may belong.

I mention an example of one such exception in section 2.2.n.

Although nos /night/ 'night' is a feminine singular noun and da /da/ 'good' is an adjective, when da /da/ follows nos /nos/, environment IIn does not apply. Thus we find nos da /nos da/ 'good night', but not *nos dda */nos ða/, in spite of the fact that the latter is what one would expect.

Neither nos /nos/ nor da /da/ belongs to any grammatical or semantic class which regularly violates the conditions of environment IIn. We can say, then, that nos /nos/ (at least) in this case constitutes an exception to the mutation rules. It is not enough merely to point this out, however. In a generative description, this exception must be described within the system.

The manner in which the exception is accounted for within the generative model is neither phonological nor grammatical. Rather, the exception is noted in the lexicon; that is, it is marked for the particular word in the base component of the grammar (see Chomsky 1965). Now the sum of all grammatical features that determine the manner of lexical insertion and permissible transformations for each word in the lexicon is found in the complex symbol of that word. Thus, nos /nos/ would be designated as [+Noun, +Common, +Count,...]. Assuming that it is this noun that forms the exception to environment IIn, we would add the feature [-environment IIn] to the complex symbol of this word.

It is important for our description that we appreciate the implications of our including a blocking feature in the complex symbol. The lexical subcomponent is found, as noted above, in the base component of the grammar. As the transformational-generative model is directional, we thus insure that the necessary information is noted in the grammar

before the application of transformational rules in the syntactic component. This is necessary, for the transformational rules establish the various environments noted in Chapter 2. Now that the blocking feature is specified, as soon as the transformations yield environment IIIn, it is known that the mutation rules in the phonology (in this case, rule 1.1.b) will not be effected.

At least in the approach to transformational grammar in which lexical items are inserted before transformational rules take place (see Chomsky 1972), the matter of exceptions to the mutation rules presents no problem. Exceptions are simply lexical items with particular blocking features in their complex symbols. A similar situation can be found in New High German, in which the word Nacht /naxt/ 'night', which is marked [+feminine], in certain grammatical conditions (the indefinite time adverbial) is marked [-feminine] in order to derive the phrase eines Nachtes /aines naxtes/ 'one (indefinite) night'. Indeed, the effect of blocking environment IIIn in the case of the Welsh nos /nos/ would be the same as we find in the German example.

Whereas an exception is idiosyncratic in nature, a counter-example represents a particular pattern. When a delimited class of items regularly fails to activate the mutation rules, then the class forms a counter-example to these rules. Now the basis of classification can be grammatical or semantic, but a basis that can be defined must exist.

Perhaps the most common example of a counter-example in Welsh mutation is the proper noun. Although a proper noun may, in some instances, undergo mutation (compare Morgan 1952:3), it usually does not, when the proper noun is the name of an individual. Thus, a sentence such as gwelodd Mair /gweloó mair/ 'he saw Mary' is grammatical in spite

of environment IIg.

As in the case of the exception, the counter-example is marked in the lexicon. Rather than marking every personal name, however, we can mark the entire class by a lexical redundancy rule by which the features [-Common] and [+Personal] imply the feature [-Mutation] in the complex symbol. Although we thus accommodate an entire class rather than a single item, the implications inherent in the counter-example for the operation of the transformational-generative model are the same as those inherent in the exception. The only difference in our description between an exception and a counter-example is that one entails the marking of a particular complex symbol while the other entails the marking of a class of complex symbols.

Leaving aside the currently uncertain position of semantics, the present description makes use of (1) a base component, which supplies the lexical items with their particular markings and which supplies the basic string; (2) a syntactic component, which arranges the basic string of marked lexical entries into the various environments; and (3) a phonological component, which interprets the lexical entries relative to the syntactic arrangement and applies the mutation rules wherever applicable. Regardless of any exceptions and counter-examples, then, the basic relationships between the phonological half and the grammatical half of mutation can be described through rules which are regular.

The regularity of the mutation system from base component to phonological component hinges upon the maintenance of the relationships that obtain between the syntax and the phonology. This is to say that all other problems which may arise can be handled by greater or less specificity in the lexical entry or by transformations, so long as the

problems do not affect the basic relationships between grammatical environment and phonological rule.

As stated at the outset of this chapter, most of the problems (such as personal nouns) which seem to exist in the mutation system can be treated as exceptions or as counter-examples. There is one other situation, however, which cannot be so treated. This case, in fact, appears to affect the basic relationships between grammar and phonology. Because the word gan /gan/ 'with' exemplifies this, I call this situation the problem of gan /gan/.

3.1 The Problem of gan. The word gan /gan/ can function either as a preposition, with the meaning 'with' or 'by', or as a conjunction introducing an adverbial clause, with the meaning 'as' or 'while'. Now it is often the case that an adverbial clause will be introduced by the conjunction a /a/ 'and' or by its negative na /na/ 'and not'. As we see in section 2.4.f, this conjunction (and its negative) is sufficient motivation for environment IVf and the application of the spirant mutation rule, if the initial consonant of the following word is a voiceless aspirated stop (or aspirata).

Thus, when the conjunction a /a/ precedes the word gan /gan/, we should expect the resulting construction to be *a gan */a gan/, because, although one necessary factor in the mutation is present (the conjunction a /a/), gan /gan/ does not have a voiceless aspirated stop in initial position. The fact is that |g| does not undergo spirant mutation and should be realized here as the radical /g/. However, *a gan */a gan/ is not the grammatical construction. The acceptable form in Standard Welsh is a chan /a xan/.

The problem in the relationship between gan /gan/ and a chan /a xan/ is a fairly obvious one. An element of mutation environment IVf causes a segment which normally does not have a different spirant mutation form either to create a special spirant mutation form or to borrow the spirant mutation form of some other segment. Throughout Chapters 1 and 2, we see that it is a basic principle of operation that the mutation system consists of regular phonological rules motivated by distinct environmental factors. The exceptions and counter-examples of section 3.0, moreover, do nothing to weaken the relationship between grammatical environments and regular phonological rules--they merely demand a greater amount of lexical marking. Now this situation brings about a problem in the basic relationship between grammar and phonology, and even within the phonology itself.

As we attempt to find a solution to this problem which will allow us to include the phenomenon in an explicit generative description of Welsh, we ought to realize that a simple lexical specification cannot provide us with the solution. In the cases of exceptions and counter-examples, all that is necessary is some mark which blocks the application of the phonological rule. In this case, on the other hand, we do not find an exception or a counter-example, but we find a deviation. It is first necessary for us to determine just what it is that is deviating and how it is deviating, before we can add any specifying mark to the lexicon.

There are two other prepositions that undergo the same deviation, and I would like to mention them here. Gyda /gəda/ 'along with' and ger /ger/ 'at' are realized in environment IVf as a chyda /a xəda/ and a cher /a xer/, respectively. It is not, then, a simple case of one

isolated word, but a case of several words which may form a sub-class of the function words. The fact that function words, words of high incidence, are involved, of course, heightens the necessity of accounting for the deviation in a generative description.

3.2 The Minor Rule Based upon |gan|. At the center of the problem of gan /gan/, we do not find a grammatical deviation in and of itself. The grammatical considerations inherent in environment IVf have not changed--only the phonological rules effected by the environment have changed from their specifications in Chapter 1. Thus, any lexical feature added to the item |gan| will have to refer to a specific phonological rule to be invoked in these particular instances. The problem is to determine what rule to posit.

As we observe the surface phenomena, we can see that a phonological /g/ alternates with a phonological /x/. As I demonstrate in section 1.0, the first phonological segment of /gan/ is the radical segment, the segment which appears in environment I, and because it is the radical, it is by definition the underlying segment |g| from which both /g/ and /x/ are derived. Thus, quite simply, the phonological rule to be marked in the lexical entry is one which derives /x/ from |g| in environment IV.

However, there appears to be a major complication. According to the mutation rules, only /g/ can be derived from |g| in environment IV (compare section 2.8). Thus, we have one environment for one underlying segment, but two phonological rules applying in that one environment. This creates a complication, for we must now find some way of telling when to use one rule and when to use the other. In order to overcome

this complication in our phonology, we can make use of the notion of a 'minor rule'.

A minor rule is a rule with limited range of application which is applied in place of a (major) phonological rule when the lexical entry of the particular item specifies that the minor rule be used. Thus, the lexical entry for |gan| could be marked [+Minor rule] so that the normal mutation rule deriving /gan/ would be superseded by the minor rule deriving /xan/.

This minor rule can be posited as follows:

$$a. \quad |g| \rightarrow /x/ \quad / \quad IV \quad \begin{bmatrix} +vcd \\ -asp \end{bmatrix} \rightarrow \begin{bmatrix} -vcd \\ +cnt \end{bmatrix} \quad / \quad \begin{bmatrix} +obs \\ +bck \end{bmatrix} \quad IV$$

From the outset, this minor rule appears suspect. As we can see from the mutation rules in Chapter 1, the tendency in mutation is for voiceless aspirated segments to become voiced unaspirated segments, not for voiced segments to become voiceless. In section 2.1, moreover, the hard mutation, which is also allegedly a case of voiced becoming voiceless, is discounted because of this very tendency. As voiced segments do not regularly become voiceless obstruents, the minor rule, as it is found in rule 3.2.a, does not appear to be consistent with the system.

Moreover, in this minor rule, we find two major feature changes--voiced to voiceless, noncontinuant to continuant. Although this is not without precedent (compare rules 1.1.d and 1.1.e), most phonological rules treated thus far in the literature change only one feature specification at one time.

This latter point may give rise to an intermediate stage hypothesis. By using an intermediate level in our derivation, we can first derive /ɣ/

from $|g|$, a process which would maintain the frication process of spirant mutation. As this $/\gamma/$ is not in the inventory of Welsh sounds, it can be realized as the closest segment to it-- $/x/$. This would result in the following minor rule:

b. $|g| \rightarrow / \gamma / \rightarrow / x / \quad / \quad \text{IV}$

$$\begin{bmatrix} +\text{vcd} \\ -\text{asp} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{vcd} \\ +\text{cnt} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{vcd} \\ +\text{cnt} \end{bmatrix} \quad / \quad \begin{bmatrix} +\text{obs} \\ +\text{bck} \end{bmatrix} \quad \text{IV}$$

As mentioned in section 1.1, however, the intermediate level makes use of a 'false step', the positing of a segment which never appears on the surface. As we see in that section, the process by which a voiced unaspirated stop is realized as a voiced fricative is not at all indicative of spirant mutation, but it is indicative of soft mutation. Were we to allow the false step derivation of intermediate $/\gamma/$ in this instance, moreover, there would be no reason to disallow it in a more general form of mutation rule 1.1.b. Such a situation would have us derive null from $/\gamma/$ in the one case and $/x/$ from $/\gamma/$ in the other.

I should like to leave environment IV momentarily in order to examine the behavior of gan $/\text{gan}/$ in environment II. Morgan (1952:385) mentions the string y gan $/\text{e gan}/$.¹ Assuming that the minor rule necessary to prohibit the derivation of *yr an (by rule 1.1.c, as in y gan $/\text{e gan}/$) acts upon the underlying $|gan|$, then we must posit a minor rule such as the following:

c. $|g| \rightarrow /g/ \quad / \quad \text{II}$

This minor rule looks suspect, for the soft mutation rules are

the broadest of the mutation rules in scope (see also Griffen 1974b). It seems irregular that a minor rule would be needed in effect to block the application of a soft mutation rule. By using the intermediate stage of rule 3.2.b, however, we can invoke a change in soft mutation, as follows:

$$d. |g| \rightarrow /y/ \rightarrow /g/ \quad / \quad II$$

Of course, such a minor rule as 3.2.d is clearly absurd. It takes the premise of the false step beyond reason, and it certainly destroys the intermediate $/y/$ hypothesis. However, if we observe rules 3.2.b and 3.2.d, an alternative intermediate stage hypothesis suggests itself. The alternative intermediate level contains the phonological segment $/k/$.

The use of the intermediate $/k/$ should eliminate the unnatural nature of the intermediate $/y/$, for we know that $/x/$ is in fact derived from underlying $|k|$ and that $/g/$ is in fact derived from underlying $|k|$ in the regular application of mutation rules 1.3 and 1.1.a. All that is needed in the new minor rule is the following:

$$e. |g| \rightarrow /k/ \quad / \quad II, IV \quad \begin{bmatrix} +vcd \\ -asp \end{bmatrix} \rightarrow \begin{bmatrix} -vcd \\ +asp \end{bmatrix} \quad / \quad \begin{bmatrix} +obs \\ -cnt \\ +bck \end{bmatrix} \quad II, IV$$

Such an hypothesis, however, is not credible because there is no rule relationship between the $|g|$ and the $/k/$. Instead, what credibility there may be in minor rule 3.2.e lies in the fact that, when it is ordered before the mutation rules, we need only apply rule 1.3 in environment IV and rule 1.1.a in environment II. Thus, we find the following systematic distribution.

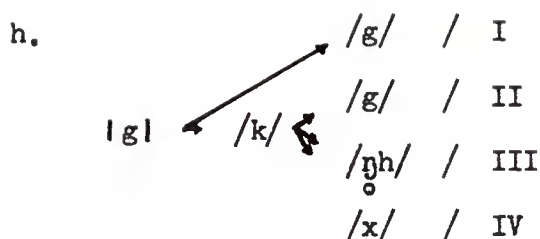
$$\begin{array}{rcl}
 \text{f.} & & /g/ \quad / \quad \text{II} \\
 & & |g| \rightarrow /k/ \quad \swarrow \\
 & & /x/ \quad / \quad \text{IV}
 \end{array}$$

In spite of the credibility lent to it by the subsequent mutation of the intermediate /k/, the minor rule 3.2.e runs counter to the tendencies of the mutation system by deriving a voiceless aspirated stop from a voiced unaspirated stop.

Moreover, as I show in the next chapter, if one of these words were to be found in environment III, the resulting phonological segment would also be formed from the intermediate /k/ (compare the form ynghyd /əŋhid/ 'together', related to gyda /gəda/). Of course, such a development would also require minor rule 3.2.e and produce the following systematic distribution:

$$\begin{array}{rcl}
 \text{g.} & & /g/ \quad / \quad \text{II} \\
 & & |g| \rightarrow /k/ \quad \swarrow \quad \searrow \quad /_{\text{h}}/ \quad / \quad \text{III} \\
 & & /x/ \quad / \quad \text{IV}
 \end{array}$$

At first glance, the systematic distribution 3.2.g looks fairly regular. However, only three of the four environments which affect initial consonants are incorporated into this statement. In environment I, the minor rule does not apply, so that /g/ can be derived directly from |g|. Taking this into account, our distribution statement may be written as follows:



This distribution statement should render one fact obvious. By itself, the underlying |g| without the intermediate /k/ can account for only one phonological segment. The intermediate /k/, on the other hand, can account for three of the four phonological segments. A much simpler solution would derive the /g/ in environment I also from the /k/, a practice which I investigate in the next section.

3.3 The Minor Rule Based upon |kan|. As we see in section 3.2, by using the seemingly obvious assumption that the initial consonant found in environment I corresponds to the underlying segment in all instances (an assumption valid throughout the mutation system to this point), we arrive at a solution to the problem of gan /gan/ which is so complex as to be unnatural. Implicit in the analysis of section 3.2 is the notion that the grammatical considerations of mutation can bring about the change of an underlying segment so that the mutation rules can produce certain distinctions in the output of the phonological component. Such a notion represents a departure from the regular relationships between grammar and phonology which is so great as to render this analysis (section 3.2) at best suspect, unless there is further strong corroboration.

As stated at the end of the last section, only one of the four ultimate phonological segments cannot be predicted from the intermediate /k/ using the already-existing rules in Chapter 1. This point raises

the possibility of using the underlying segment $|k|$ and then a minor rule deriving $/g/$ from $|k|$ in environment I. Such a solution would increase the simplicity of our description considerably.

Of course, one area of the description that can be simplified by using underlying $|k|$ is the systematic distribution. Statement 3.2.h represents a complex distribution requiring two rules for the derivation of each of three phonological segments. A minor rule such as 3.3, below, however, would have two rules deriving only one of the four segments, if any.

Of far greater importance to our description is the impact of such a minor rule on the mutation system itself. The mutation rules are morphophonological in the sense that they are motivated by grammatical considerations, irrespective of phonological considerations. A minor rule of the type found in 3.2.e would have mutation rules operating on an intermediate segment--not on the underlying segment, as we find elsewhere throughout the system. A minor rule operating on underlying $|k|$, on the other hand, would maintain the notion that the mutation rules operate directly on the underlying segment. By thus allowing a greater degree of conformity with the mutation system, this alternative solution lends considerable simplicity to the system.

For these reasons, then, as well as for others considered later in this section, we can posit the following minor rule:

$$|k| \rightarrow /g/ \text{ / I} \quad \begin{bmatrix} -vcd \\ +asp \end{bmatrix} \rightarrow \begin{bmatrix} +vcd \\ -asp \end{bmatrix} \text{ / } \begin{bmatrix} +obs \\ +bck \\ -cnt \end{bmatrix} \text{ I}$$

Although minor rule 3.3 is superior to minor rule 3.2.e, I include the complicated arguments in section 3.2 in order to demonstrate two

areas of concern that might weaken minor rule 3.3. First of all, minor rule 3.3 operates in environment I, the unspecified environment. It is otherwise axiomatic that where environment I exists, no mutation is effected. In section 3.2, however, we see the complexity of description to which this supposed axiom would lead us. Furthermore, the minor rule is not, strictly speaking, a mutation rule. Thus, we can still maintain that mutation is not effected in environment I.

The concern over the nature of environment I leads directly to the second area of concern. This second area has to do with the notion of 'absolute neutralization' (see Kiparsky 1973). By using an underlying |g|, we maintain the 'alternation condition', avoiding absolute neutralization. This is to say that the underlying |g| is reflected in one of the phonological segments on the surface, thereby maintaining some overt justification for positing the underlying segment as |g|. An underlying |k|, on the other hand, is not realized on the surface as a /k/, thereby failing to maintain this overt justification.

Of course, it is fairly easy for the linguist to posit an abstract underlying segment which does not occur on the surface in the description of an 'exotic' language (for example, Hyman 1970). Yet, any linguist who posits such an abstract segment in a well-known European language had best prepare a good defense. Welsh with its earlier forms boasts fourteen centuries of literary tradition, so this abstractness creates a particular area of weakness for the minor rule, if only by the fact that attacks against it will be strenuous.

I should point out that minor rule 3.2.e also makes use of an abstract segment in the form of the intermediate stage. Minor rule 3.3, then, is not really any more abstract than 3.2.e--it merely makes

the neutralization into a more explicit statement. If we wish to avoid abstractness, we will have to derive the phonological segments /g/, /ŋh/, and /x/ directly from |g|.

As stated in section 1.2, voiceless aspirated nasals are only found as a result of nasal mutation. Moreover, the voiceless aspirated nasals can only be derived from their voiceless aspirated stop cognates. Indeed, this is the origin of the aspiration in the nasals. An occurrence of /ŋh/ can therefore only be derived from underlying |k|, not from underlying |g|.

Furthermore, as we direct our attention to the string a chan /a xan/, we find a voiceless velar fricative. This segment is not followed by an occurrence of /w/. Now it is extremely rare (if, indeed, it is even possible in literary Standard Welsh) that we find an initial /x/ which is not followed by /w/ except where that /x/ is the spirant mutation form of /k/.² Thus, the speaker would assume, given the string a chan /a xan/, that the /x/ is derived from |k|, not from |g|.

There is also direct historical evidence to support minor rule 3.3 and the underlying |k|. Although I do address this evidence in section 4.1, I do not believe it proper to introduce historical evidence at this point, as we are involved in these first three chapters with a synchronic description of the Welsh mutation system, and such a synchronic description should be able to stand on its own merits. On the other hand, there is some historical evidence which may be relevant to the synchronic description, for it pertains to a tendency which may very well exist in Modern Welsh. This tendency is lenition (see section 1.1). According to Jackson (1953:23), the process of lenition is found in the fifth century A.D. in both Brythonic (>Welsh) and Goidelic (>Irish).

due to some phonological 'nuance' inherited by both languages from Common Celtic. Indeed, both Welsh and Irish still maintain remarkably similar lenition. If this tendency, which was strong enough to affect two languages after they had separated from a common source, still exists in Modern Welsh, then a minor rule deriving /g/ from |k| is certainly not unexpected. I return to this tendency throughout the following chapters.

In spite of the problems with absolute neutralization, the evidence seems to support minor rule 3.3. Clearly, the alternatives create more problems than they solve. However, there is still need for some strong corroboration--some evidence which supports the notion that rule 3.3 adequately describes the deviation in the mutation system.

3.4 Evidence for the Minor Rule. The analysis of the deviation through minor rule 3.3 in the previous section certainly leads to a simple, concise description of the phenomena involved. This description affords maximum generality and conformity with the mutation system. Finally, the description by way of a minor rule is explicit and adheres to the generative methods of description.

In spite of the fact that this analysis provides a simple, general, generative solution to the deviation, the phenomena which are involved in minor rule 3.3 still constitute a deviation. A deviation must have corroboration--some further evidence from some other point in the linguistic system which supports the proposed solution to the deviation. By corroboration, I do not mean simple recitations of data which mirror exactly the deviation examined above. Instead, we need some evidence which more closely ties the phonological voiced unaspirated stop in environment I to the underlying voiceless aspirated stop, further

justifying our analysis.

In order to find corroboration for our minor rule, we need go no further than the class of prepositions itself. There are two pairs of prepositions crucial to this analysis. They are tros,dros /tros,dros/ 'over' and trwy,drwy /tru:ɪ,dru:ɪ/ 'through'.

In environment I, both members of each pair may be used in free variation. For example, the phrase tros y cae /tros ə ka:ɪ/ 'over the field' may be found in the same text as the phrase dros y cae /dros ə ka:ɪ/ 'over the field'. Moreover, the phrase trwy'r drws /tru:ɪr drus/ 'through the door' may exist along side of the phrase drwy'r drws /dru:ɪr drus/ 'through the door'. At this point, there is not any motivation for deriving the second member of each pair from the first, as a soft mutation environment is lacking. And there is certainly no motivation for deriving the first from the second, as this would contradict the 'normal' tendency found in the mutation system.³

It is in environment IV that we find the needed corroborating evidence. If the prepositional phrases mentioned above are preceded by the conjunction a /a/ 'and', then the preposition enters environment IVf. We might expect, then, to derive the phrases a thros y cae /a θros ə ka:ɪ/ 'and over the field' and *a dros y cae */a dros ə ka:ɪ/ from the first pair, and the phrases a thrwy'r drws /a θru:ɪr drus/ 'and through the door' and *a drwy'r drws */a dru:ɪr drus/ from the second pair. The second member of each pair, however, is not found. When either member of the two pairs enters environment IV, the spirant mutation form from the first member is derived, regardless of which member of the pair is used in environment I.

The fact that only the spirant mutation form of underlying |t|

is permissible in environment IV indicates that the underlying form of both members of the first pair is |tros| and of both members of the second pair is |tru:ɪ|. In order to derive the optional second member of each pair, the underlying form must undergo a minor rule of the form found in rule 3.3 in environment I.

The alternation of /t/ and /d/ both derived from |t| in environment I is evidence that a voiced unaspirated stop can indeed be derived from a voiceless aspirated stop in the unspecified environment. Moreover, the existence of /t/ along side of /d/ satisfies the alternation condition.

Perhaps a more interesting pair of this type is found in tan /tan/ and dan /dan/. Like gan /gan/, this pair represents a preposition meaning 'under' and a conjunction introducing an adverbial clause with the meaning 'while (in the past)'. The use of tan /tan/ as a preposition is fairly rare except in certain compound prepositions, such as oddi tan /oði tan/ 'from under'. Tan /tan/ is more often used in the adverbial construction, where (as noted above) the conjunction a /a/ is often found with its environment IVf. Of course, when a /a/ does precede either tan /tan/ or dan /dan/, the resulting string is a than /a θan/. The close grammatical and semantic relationship (adverbially) between tan,dan /tan,dan/ and gan /gan/ adds further credence to the minor rule hypothesis.

Thus, the pairs tros,dros /tros,dros/, trwy,drwy /tru:ɪ,dru:ɪ/, and tan,dan /tan,dan/ supply the evidence needed to show that gan /gan/, gyda /gəda/, and ger /ger/ all have an initial underlying |k| and undergo a now-more-general minor rule in environment I.

This analysis is, in fact, suggested by Morgan (1952:452), who

claims that in these words the t /t/ and c /k/ are resurrected (cael eu hadfer) after the conjunction a /a/ in order for the spirant mutation to be effected. Now Morgan is speaking in historical terms, but clearly the application of this 'resurrection' can be seen in the synchronic phenomena.

The minor rule now must be made more general in order to include the dentals as well as the velars. Moreover, the minor rule also affects labials, as shown in the next chapter. Thus the rule in its most general form can be written as follows:

$$\begin{bmatrix} -vcd \\ +asp \end{bmatrix} \rightarrow \begin{bmatrix} +vcd \\ -asp \end{bmatrix} / \begin{bmatrix} +obs \\ -cnt \end{bmatrix} \text{ I}$$

This minor rule 3.4 can now be incorporated into the grammar of Welsh. The rule itself is in the phonological component, but the lexical items which undergo the rule are marked in the lexicon with the feature [+Minor rule 3.4]. Thus, the deviation can be accounted for in a generative description.

3.5 The Synchronic Description. These first three chapters present a synchronic description of the Welsh consonant mutation system. Chapter 1 notes the regular phonological rules inherent in the system; Chapter 2 mentions the grammatical categories and constructions which motivate the system; and Chapter 3 deals with the exceptions, counter-examples, and deviations of the system and how these can be accounted for in a generative description.

This description is explicit, in that the rules are posited and the methods for incorporating the rules are treated. On the other hand,

this description is not intended to be exhaustive. However, additional information needed to describe the mutation system will not change the methods used here. Any additional environments need only be added to the existing classifications. Moreover, exceptions and counter-examples can be marked in the lexicon just as they are in section 3.0. Even if any other deviations may be found (which is doubtful) they can be handled in the same way as is the problem of gan /gan/ in this chapter. Phonological additions can also be incorporated if necessary. For example, as shown in Griffen 1974b, the inclusion of the affricates in the mutation system can be accomplished with the existing phonological rules.

As this has been a synchronic description, it has not been my concern how these rules and these environments have come into being in the Welsh language. I have only been concerned with how this system can be described at this point in time. With the deviation, however, we find a set of phenomena which demonstrates some degree of instability--two rules operating on the same form in the same environment. This instability of the deviation appears to be an indication of linguistic change.

As the deviation supplies us with the element of historical linguistics, I leave the purely synchronic nature of the system and consider the historical aspects in the next chapter. It is this deviation which leads most directly into the matter of the new Welsh consonant shift.

NOTES TO CHAPTER 3

¹This form is only found in written Welsh based upon earlier texts. It becomes clear by the end of this chapter that the article y /ə/ in this case brings about environment II--as opposed to other cases in which it does not--for example, the preposition y tu mewn i /ə ti məun i/ 'outside of'.

²In fact, it can be argued that we should add a separate phonological segment /xw/ with the feature [+round] to Table 1.0.c, to handle con-mutation forms of the voiceless velar fricative in initial position.

³To be sure, there is the matter of hard mutation, which I discuss further in section 5.1.

CHAPTER 4
THE DEVIATION--HISTORICAL ANALYSIS

4.0 The Generalization of the Minor Rule. Up to this point, we have been concerned with a synchronic analysis. In such an analysis, it does not matter where the deviation found in the problem of gan /gan/ (in the previous chapter) originated. Nor does it matter how this deviation has come into existence, nor where it may be leading. It is enough in a synchronic analysis to show that the minor rule 3.4 offers the best resolution of the deviation.

It is pointed out in section 3.4 that Morgan (1952:452) attributes the deviation of such words as gan /gan/ and dan /dan/ to the 'resurrection' (adfer) of c /k/ and t /t/, respectively, as radicals, from which we may posit the underlying segments. Apart from the fact that this reference to the single most authoritative work on mutation converges upon the minor rule hypothesis, in our synchronic analysis the opinion of Morgan is of limited application.

The deviation characterized by minor rule 3.4, however, is not of particular interest in the synchronic description of Welsh, except for its effect upon some generative phonological points of theory (see section 3.3). Primarily, the deviation is of historical interest. As stated in section 3.5, the very fact that we have a minor rule operating in Welsh is an indication that there may be some historical developments taking place. This connection between the minor rule as an entity of description and historical change is a central part of historical

linguistics as it is described through the generative school.

Sound change comes about as a result of the reinterpretation of the acoustic signal by the language learner (compare Anttila 1972:198). This is to say that the learner creates a phonology which is different from that created by the linguistic source. The difference between the learner's phonology and the source's phonology can be described in the generative mode through the existing theoretical devices.

In phonological theory, as found in Chomsky and Halle 1968, Schane 1973, and so forth, we begin with a 'deep' representation and apply rules to this representation and to subsequent intermediate representations in order to derive the 'surface' forms. Thus, the generative method must always start with an item. In historical linguistics, this item is the underlying 'deep' form of the older dialect. An historical change involves a deviation from the derivation used in the older dialect.

The change, then, in historical forms can be described through newer rules applying to older forms. According to King 1969, there are four classifications of change, as seen through the generative framework. The first is restructuring--the underlying form of the older dialect changes, without affecting the rules which derive surface forms. The other three classifications maintain the older dialect's underlying forms but change the rules that derive the surface forms from them. We may find rule addition (a new rule added to the derivation), rule deletion (an old rule becoming obsolete), or rule reordering (a rule which had appeared before another rule coming after it, thus changing the output form).

It should be fairly clear that in this framework a rule cannot be gradually added or gradually deleted or gradually reordered. The

change must be abrupt. Yet, as we look at past sound changes, we can see that the language does not abruptly change from, for instance, Brythonic to Old Welsh. The change itself comes about gradually throughout the language community. The gradualness of the change throughout the language community is explained by the notion that although the restructuring or rule change occurs abruptly, the spread of this change through the community is gradual. This abrupt change-gradual spread hypothesis is a major tenet of generative theory (see King 1969:119).

A language at one stage can be differentiated from the same language at another stage through a description using restructuring and rule change. But what of the period between the two stages? Indeed, the heterogeneity of the language community is an indication that the language is continually undergoing change (see Weinreich, Labov, and Herzog 1968).

It is in this period of on-going change that the notion of the minor rule is invoked. In the case of rule addition, for example, we find during the gradual spread of the added rule that the older rule is still in effect in some dialects. As there is no restructuring, we find two rules (assuming that derivation from one stage to the next involves a rule) both operating upon the same underlying segment in the language community. In order to account for this situation, we say that the newer rule is a minor rule which is in competition within the language community. This minor rule then spreads, by becoming the more prestigious form, until it displaces the older rule. (Compare also H. Anderson 1973.)

Thus, within the generative approach to language change, the minor rule may be symptomatic of on-going linguistic change. On the other hand, it may very well be that a minor rule enters the language (by change, to

be sure) but remains a simple exception to rules of the grammar. As an exception, such a rule would be entered for a limited number of words in the lexicon. As we see in section 3.0, for example, the fact that the phrase nos da /nos da/ 'good night' does not bring about the mutation rule 1.1,b because of environment IIn is not an indication of a change in the language by which environment IIn may be eliminated. It is simply an exception of no historical consequence.

In order for a minor rule to be indicative of linguistic change, it must satisfy a crucial requisite of historical development--it must spread. So long as a minor rule is spreading, no matter how gradual that spreading may be, a linguistic change is occurring by definition.¹

The spreading of a minor rule is known as 'rule generalization'. There are two ways in which generalization can take place in generative phonology. On the one hand, generalization is said to occur when a rule applies to more environments. This is central to linguistic change. On the other hand, a rule may generalize so as to affect an entire natural class (see section 1.1). This is also an important aspect of synchronic description as well as historical change. As we see in this chapter, both types of generalization affect the minor rule 3.4, indicating that this is, indeed, a case of linguistic change.

4.1 The Historical Development of the Minor Rule. In order to show that the minor rule represents a current process of linguistic change, it is necessary to demonstrate that the rule is indeed generalizing to more and more words. That is to say that it must be shown that the minor rule is a growing phenomenon, not simply a relic surviving from

a now-unproductive historical accident.

As I mention above, Morgan (1952:452) attributes the deviation of gan /gan/, for example, to the 'resurrection' of the radical c /k/. Likewise, the deviations of the other function words with initial velars can also be traced to this 'resurrection'. As we turn our attention to the historical development of the deviation, it becomes proper and necessary to consider where this 'resurrected' c /k/ comes from.

In Old Welsh, gan /gan/ is found spelled as can or cant (see Morris Jones 1913:405; Jackson 1953:496; Evans 1960:124). Thus, in the Old Welsh period (ninth through eleventh century) the radical c /k/ was used exclusively in environment I. There is therefore no reason to assume that the minor rule was in existence at this point in history.

In Middle Welsh (twelfth through fourteenth century), on the other hand, both can (or kan) and gan can be found in environment I (see Morris Jones 1913:405; Evans 1960:124). The introduction, then, of the minor rule for the velars occurred during the Middle Ages. Even in the Early Modern Welsh poetry, moreover, the radical c /k/ is sometimes found (Morris Jones 1913:405).

This history of gan /gan/ (and the others) indicates that the minor rule came into existence in the Middle Ages and competed with the major derivation into the Early Modern Welsh period (fifteenth through sixteenth century), at least in the more conservative verse. In Modern Welsh, however, the minor rule has totally eclipsed the older forms such that *can is not even listed in Evans and Thomas 1968, in spite of the fact that many obsolete forms are included with asterisks in that work.

The extent to which the minor rule became dominant in the Middle Welsh period is open to some doubt. The uncertainty arises from the fact that the consonant mutations were not regularly designated in Middle Welsh orthography (Evans 1960:9). Thus, a scribe interpreting the minor rule for the soft mutation could very well write can for /gan/.

An interesting aspect of the growth of the minor rule throughout these periods lies in the two different functions of gan /gan/. As noted in section 3.1, this word functions as a preposition and as a conjunction introducing an adverbial clause. There is reason to believe that the minor rule dominated the word in its prepositional function before it dominated it in its adverbial function. According to Morris Jones (1913:443), it does not appear to undergo the minor rule in its adverbial function in Middle Welsh. Furthermore, the Modern Welsh conjunction canyis /kanis/ 'since' is still found, and it is a contraction of the Middle Welsh can 'since' and ys 'it is' (see also Morgan 1952:541).

Thus, we can set the following time-table for the domination of gan /gan/ by the minor rule 3.4. The minor rule becomes an optional variant of the standard derivation in the early Middle Welsh period. During this period, it gains prestige over the prepositional form, but it lags in the adverbial form. By the Early Modern Welsh period, the traditional form of the preposition only survives in the conservative verse poetry, and it begins to disappear in the adverbial function. By the Modern Welsh period, the minor rule is obligatory.

So far, I show that an historical progression of the minor rule is traceable through the Early Modern Welsh period. But in itself, this does not tell us much about the language today. The question

remains as to whether or not the minor rule is still a viable factor in Modern Welsh.

In order to relate the generalization of the minor rule to contemporary Welsh, it is only necessary to cite the pairs of prepositions tan,dan /tan,dan/, tros,dros /tros,dros/, and trwy,drwy /tru:i,dru:i/, mentioned in section 3.4. Yet, the fact that minor rule 3.4 is optionally invoked in these cases does not prove that the rule is still spreading--it is possible that the entire process has been frozen since the Early Modern Welsh period. Indeed, these alternations were noted in 1567 by the Welsh grammarian Gruffydd Robert (1927:3:39-40), who wrote that the words tros, trwodd, traw, cann, cidag were more usually spoken as dros, drwodd, draw, gann, gidag (his orthography). Thus, we need some more evidence to show that the generalization (the spreading of the rule to new environments) is still, in fact, active.

As mentioned in section 3.4, an interesting parallel to gan /gan/ is found in the pair tan,dan /tan,dan/. It is interesting because of the fact that both function as prepositions and as conjunctions introducing adverbial clauses. In their adverbial functions, moreover, they are semantically quite similar.

In Old Welsh, tan,dan /tan,dan/ is in a radically different phonological shape. It is written as gotan or gutan (see Morris Jones 1913:399; Jackson 1953:389; Evans 1960:135). Clearly the t is found in this period, although it is not in the environment of the minor rule. In Middle Welsh, the alternation tan~dan is found extensively (Morris Jones 1913:399; Evans 1960:135), as it is in Early Modern Welsh (as shown by the reference of Gruffydd Robert, above).

It is in the contemporary Modern Welsh that we find a significant

development. This development can be demonstrated by referring to two recent textbooks--James 1966 and Bowen and Rhys Jones 1960. The advantage of citing a textbook is that a textbook is usually more internally consistent in its use of the language than is a body of data (such as Fynes-Clinton 1913). Thus, although it may not be an accurate representation of what is actually said, it does represent what one scholar considers to be the more usual forms, at least in that scholar's usage. We may consider the textbook, then, to be a comment on what is considered the 'norm'. It is important for us, whenever we consider what is written in a textbook, to consider first just what kind of language that textbook represents. In Welsh especially, we must determine a relative degree of conservatism--whether the language used in the textbook represents a more conservative (closer to the Standard) or a less conservative (closer to the colloquial usage) approach to Welsh.²

According to both James 1966 and Bowen and Rhys Jones 1960, dan /dan/ is the exclusive form of the preposition. The more conservative James 1966 lists tan /tan/ as the only form of the adverbial clause conjunction. The less conservative Bowen and Rhys Jones 1960, on the other hand, lists dan /dan/ as the only form of the adverbial clause conjunction. Although the latter accepts only dan /dan/, both members of the pairs tros,dros /tros,dros/ and trwy,drwy /tru:ɨ,dru:ɨ/ are cited as acceptable.

When we compare the discrepancy between the more conservative and the less conservative approaches to Modern Welsh with the time-table for the domination of gan /gan/ by the minor rule, we can discern one important fact. Dan /dan/ appears to be at that point of development today at which gan /gan/ was found in the Early Modern Welsh period--some

five centuries ago. Thus, the process of generalization of the minor rule 3.4 is not only still active, but it is also following the same orderly progression as it did in Early Modern Welsh.

There are no prepositions which begin with a labial stop, but there are some other function words. In 1913, Morris Jones noted that here too there were voiced-voiceless pairs, as in ple /ple/ and ble /ble/ 'where (interrogative)' and pia /pi:ai/ and bia /bi:ai/ 'whose is (are)'. According to Morris Jones (1913:359), in the spoken language both /p/ and /b/ are heard, and the /p/ is particularly heard in North Wales, which is considered the more conservative dialect region.

The pair ple, ble /ple, ble/, for example, could represent an alternation between two separate forms (as in Hoenigswald 1960) or it could represent the presence of the minor rule. In the former case, mutations of ble /ble/ would be formed from an underlying |b|, and this alternative form would be a case of restructuring (or relexicalization). In the latter case, ble /ble/ would behave like gan /gan/ or dan /dan/, forming its mutation forms from the underlying voiceless aspirated stop.

Bowen and Rhys Jones (1960:29) lists ble /ble/ as the contracted form of pa le /pa le/ 'what place', but it does not list ple /ple/ as an alternative form. In environment IIIId, however, it gives the contraction of yn /en/ and ble /ble/ as ymhle /emhle/ 'in what place', a clear indication that it is the minor rule 3.4 which is causing a deviation of the same type described above.

Thus, the minor rule is an on-going process which is generalizing throughout the function words of Modern Welsh. Moreover, it not only affects velars and dentals, as Gruffydd Robert noted in 1567, but it is now affecting labials.

4.2 The Generalization to the Natural Class. As pointed out in section 4.0, generalization can occur with respect to the affectable environments of a rule. This is occurring as the minor rule affects the labials, for now the rule not only applies to prepositions and adverbial clause conjunctions, but it also applies to other function words as well, such as question words and the possessive relative pronoun-verb. Moreover, generalization can also occur with respect to a natural class of segments. Again, this is occurring, as the minor rule now affects labials.

Now the generalization of the minor rule such that it affects an entire natural class is an important development, especially from the standpoint of generative theory. Such a development involves the 'simplicity metric'. According to King 1969, languages tend to change in such a way as to become more simple. In order to understand the role of simplification in the generative approach to historical linguistics, it is necessary first to consider the general framework employed by the generative phonologist.

Generative phonological rules are formulated in features. Each feature tends to limit the scope of the particular rule. When we remove a feature, then, the rule applies to more segments, thus becoming more general. It is important to note that the process by which the rule becomes more general is precisely the same as the process by which the rule becomes simpler--the removal of an item.

According to King 1969, languages tend to become simpler. Thus, the rules within the languages tend to become more general--applying to more items. This notion is closely allied to the traditional approach of analogy.

As a Welsh dialect accepts the affricates /č/ and /j/ from English,

for example, the mutation rules must add the feature [-strident] to block the mutation rules from applying to the affricates. In several dialects, soft mutation has generalized so as to affect the new affricates, and this is reflected in the removal of the feature [-strident] from the rules. In the Dyffryn Nantlle dialect (see R.O. Jones 1971), moreover, the same has happened with respect to the nasal mutation rules, resulting in the feature [-strident] being removed from these rules. As pointed out in Griffen 1974b, the removal of the feature simplifies the rule and reflects greater generalization within the grammar. Moreover, as the rules can now be written with fewer features and the plosives and affricates are phonetically similar, the generalization and simplification reflect inclusion of affricates into a natural class of stops, at least in the affected dialects.

The first segments that appear to be affected by the minor rule are the velars. A rule affecting only the velar stops can be posited as follows:

$$a. \quad \begin{bmatrix} -vcd \\ +asp \end{bmatrix} \rightarrow \begin{bmatrix} +vcd \\ -asp \end{bmatrix} / \begin{bmatrix} +obs \\ +bck \\ -cnt \end{bmatrix} I$$

This is identical to rule 3.3.³

As the dentals are affected, the rule can be posited as follows:

$$b. \quad \begin{bmatrix} -vcd \\ +asp \end{bmatrix} \rightarrow \begin{bmatrix} +vcd \\ -asp \end{bmatrix} / \begin{bmatrix} +obs \\ +bck \\ +cor \\ -cnt \end{bmatrix} I$$

Rather than reducing the number of features, this rule 4.2.b has increased the number of features over 4.2.a. This does not mean that the rule has become less general--indeed it has become more general, for it now affects two positions of articulation rather than one.

As the labials are affected, however, we find an unmistakable simplification, as follows:

$$c. \quad \begin{bmatrix} -vcd \\ +asp \end{bmatrix} \rightarrow \begin{bmatrix} +vcd \\ -asp \end{bmatrix} / \begin{bmatrix} +obs \\ -cnt \end{bmatrix} I$$

Now the minor rule has reached its simplest form. Furthermore, as we consider the requisites of a natural class (see section 1.1), we can see that the rule now affects an entire natural class.

As it now stands, this rule (identical to rule 3.4) rewrites all voiceless aspirated stops as voiced unaspirated stops. As such, then, it changes one natural class into another. When we couple this fact together with the fact that the minor rule is an on-going phenomenon, we might ask what would be the logical extension of these developments. I address this matter in the next chapter.

NOTES TO CHAPTER 4

¹I return to the point of this definition in Chapter 6.

²As can be seen in its consistent use of the two-part negative (nid...dim (ddim), as opposed to nid...), Bowen and Rhys Jones 1960 is less conservative than James 1966 (see Pilch 1971).

³The specification [+obstruent] can replace the features to the left of the arrow. I have not done this, because I want to maintain the parallel structure between these rules and the mutation rule 1.1.a.

CHAPTER 5
A NEW WELSH CONSONANT SHIFT

5.0 Sound Change and Consonant Shifts. As stated in section 4.0, sound change comes about as a result of the reinterpretation of the acoustic signal. Of course, any major deviation in the interpretation of sounds in the language learner from the accepted norm of the learner's source (whether as a result of the failure of the source to articulate in a manner that would make the sound system of the source clear to the learner or as a result of conscious alteration of the data, as is typical in abductive situations) leads to the learner constructing a phonological system which is not identical with that of the source (if, indeed, two systems can be identical). Insofar as particular sounds in the source phonology do not correspond to those in the learner's phonology, we can say that there is a change in these sounds in the language. Thus, if the source uses the segment /t/ in a particular environment and the learner interprets this as the segment /d/, then by convention we say the the /t/ is being changed to /d/ in that particular environment.

Now it is crucial that we recognize the difference between sound change and the conventionalized description of sound change. The actual event of a sound change involves the transmission of the language from one generation of speakers to the next. In reality, there is no change involved here at all--just the establishment of correspondences between one generation and the next. Such correspondences exist within the language so that the speakers of one dialect may understand the speakers

of other dialects (compare Anttila 1972:48; H. Anderson 1973).

In the generative framework, as pointed out in section 4.0, one usually treats the older form as the underlying form (or at least as an intermediate form) and derives the newer form from it. In deriving the newer form, the linguist notes that there has been a change in the underlying form or in the rules deriving the surface form between the previous description and the newer one. The nature of the change gives the linguist a classification of the change consistent with the model. This method may describe the actual event, but it is not to be taken as being the event itself.

A sound change can be limited to a single segment. For example, Old Welsh /β/ (mentioned in section 1.0) corresponds to Modern Welsh /v/. Thus, we say in our description that /β/ has become /v/.

On the other hand, a sound change can include all members of a natural class. In section 4.2, for example, we see that the minor rule involved in the deviation outlined in Chapter 3 affects not isolated segments, but all members of the class of voiceless aspirated stops (aspiratae) in a particular environment. In fact, this sound change involves rewriting all members of one natural class (the aspiratae) as cognate members of another natural class (the mediae) in a particular environment.

Such a sound change, in which one natural class is rewritten as another natural class, is known as a consonant shift. Of course, the notion of a shift has meaning only in relation to the description of language. It describes the fact that in one generation where we find /p/, /t/, and /k/, in some subsequent generation we find corresponding /b/, /d/, and /g/. The phonological change involved in this consonant

shift in which voiceless aspirated stops become voiced unaspirated stops can be described in the generative model by using the minor rule 3.4, which would in the process of the shift become a major rule.

The last point, that a consonant shift in which voiceless aspirated stops become voiced unaspirated stops can be described by minor rule 3.4, should not be taken lightly, for its implications are quite far-reaching. By such a statement I mean that in any language with a phonological system in which there are voiceless aspirated stops cognate with voiced unaspirated stops, if the former natural class should change to the latter, then that exact rule which I designate as minor rule 3.4 applies in the description. This quality of minor rule 3.4 to apply in similar situations in all languages is a result of the generative interpretation of features as universal entities. Thus, the feature [-voiced], for example, is the same for Welsh as it is for English or Chinese. Moreover, the feature [-voiced] is the same in initial position as it is in medial or final position--a point central to the argument of this chapter.

As we view the relationships between consonant shifts and phonological environments, we can consider two environment types conditioning the shift (provided we have any shift at all). We can have a shift with a restricted environment. That is to say that the shift from, for example, voiceless aspirated stops to voiced unaspirated stops takes place in some environments, but not all. For example, in Danish these two classes only contrast in word-initial position (Fischer-Jørgensen 1954), having been neutralized in other environments as a result of earlier shifts.

Generally, however, when we use the term consonant shift, we imply

a sound change involving a natural class of consonants taking place with an unrestricted environment. Although the shift with an unrestricted environment may be affected by exceptions (individual lexical items), such a shift represents the notion of 'regular' sound change.

I use the minor rule 3.4 as an example of a sound change involving a natural class, and possibly as the basis of a consonant shift. Phonologically, however, minor rule 3.4 is identical to soft mutation rule 1.1.a. This raises a question as to why rule 1.1.a is not to be considered evidence of linguistic change. The reason why it is not to be considered as such lies in its grammatically restricted environment. The application of the soft mutation rule 1.1.a signals grammatical information by the fact that the voiceless aspirated stops contrast with the voiced unaspirated stops. The presence of contrast in the system, then, and the grammatical function of this contrast serves to maintain the functional distinction between the two natural classes. In the case of a consonant shift in which one class merges with the other, as we see as the result of minor rule 3.4, the maintenance of distinctive function within these classes is necessarily suspended.

Thus, the effect of an unrestricted consonant shift in the phonological system of a particular language is the suspension of contrast between the two natural classes of consonants involved. This does not mean that all voiceless aspirated stops, for example, disappear from the actual acoustic data. It means, rather, that if a speaker utters a voiceless aspirated stop after a shift from voiceless aspirated to voiced unaspirated stops has taken place, then such a segment does not serve a distinctive function in the phonology (compare the Danish example cited above). In generative terms, a consonant shift is phonological in that it may

be described as altering the systematic (and even taxonomic) phonemic structure of the phonological component, although the systematic phonetics may produce an obsolete segment in free variation with the newer form.

The diachronic approach to the spreading of the minor rule 3.4 in Modern Welsh, which I treat in the previous chapter, has considerable implications when combined with the notions of the consonant shift. First of all, as we see in section 4.2, the minor rule affects an entire natural class--changing (in the description) voiceless aspirated stops to their voiced unaspirated cognates. As we see in this section, such a rule changing one natural class to another in the unmarked environment (environment I) serves to suspend the contrastive function of these two classes and may be an element of a consonant shift.

Furthermore, the suspension of contrastive function between the two classes is not an isolated event. As we see in section 4.1, the environment of the minor rule is gradually spreading (compare King 1969:119) among function words (and, as pointed out in section 5.3, this spreading may apply to some content words as well). Such a development may, then, represent a shift in the restricted environment of word-initial position.

In most cases, a consonant shift refers to a change in consonant classes in an unrestricted environment. In the generative framework, for the change inherent in minor rule 3.4 to be considered a consonant shift in a ~~restricted~~ environment, the rule would have to spread to all items in word-initial position. In order for minor rule 3.4 to represent a consonant shift in an unrestricted environment, the rule would not only have to spread to all items in word-initial position, but it would also have to spread to all environments of all items.

Of course, there has not been a complete shift parallel to minor rule 3.4 in the Welsh language. On the other hand, there may be a shift in progress. In the generative framework, in order to prove that such a shift is indeed in progress, two pieces of evidence are necessary and sufficient. Firstly, there must be a single rule changing an entire natural class (in the inventory of underlying segments). Secondly, the rule must be generalizing to all environments.

These two requisites of our proof necessarily depend to a great extent on the universal quality of features. This quality enables us to use the same minor rule (insofar as the actual phonological change is concerned) in all of these environments and makes a shift evident by the very use of the same rule in the various environments.

One matter must be stressed. As we cannot analyze the workings of the speaker's mind, our proof is necessarily limited to his performance, and more precisely to our description of his performance. The danger that lies herein should be evident. The proof is in the manner of describing the performance, but the description is not the event. I return to this matter in the next chapter.

5.1 The Position of Neutralization. The minor rule does affect a limited environment in word-initial position (Chapters 3 and 4), and I return to that position in section 5.3. I should now like to examine the realization of stops in word-final position.

Because I treat the notion of 'hard' mutation' in section 2.1, this phenomenon is perhaps the best avenue through which to approach the role of word-final stops. In this phenomenon, a word-final voiced unaspirated stop alternates with a medial voiceless aspirated stop.

Thus, teg /teg/ 'fair' has the equative form teced /teked/, for example.

As I point out in section 2.1, the more general solution to this problem, in generative terms, would involve the application of the soft mutation rule 1.1.a to an underlying word-final voiceless aspirated stop. There is a major difference, however, between this application of rule 1.1.a and other applications of the same rule in the environments of the soft mutation, besides, of course, the evident difference that this application is in word-final position. The difference is that there is contrast maintained in soft mutation due to its nature as a morphophonological rule (compare section 5.0), but there is no functional contrast in this application of rule 1.1.a, for there is no occurrence of a word *tec */tek/ with which teg /teg/ may be contrasted. Not only is this the case with this particular adjective, but this is the case with all adjectives.

It appears, then, as though we have a rule voicing and deaspirating word-final stops in adjectives which serves no contrastive or distinctive function. But the soft mutation rules apply morphophonologically in order to distinguish grammatical conditions. Insofar as this rule does not serve to reflect the grammatical conditions but applies in all occurrences in word-final position, what we have is not soft mutation rule 1.1.a at all, but the minor rule 3.4.

The process described in adjectives can also be found in certain noun-verb categories. For example, the verb bwyta /bu:ɪta/ 'eat' alternates with the noun bwyd /bu:ɪd/ 'food', the verb pysgota /pəsgota/ 'fish' alternates with the noun pysgod /pəsgod/, etc.

At this point, an historical Cymrist would probably take issue with my analysis. As I point out in section 2.1, the alternation

known as 'hard mutation' is a result of an /h/ in Middle Welsh occurring between the adjective, ending in a voiced unaspirated stop, and some of the adjective endings. Moreover, the voiceless aspirated stops found in the verbs cited above and others like them result from the occurrence of an /h/ in a factitive ending applied to the noun (ending in a voiced unaspirated stop) also in the Middle Welsh period. In both cases, a voiced unaspirated stop followed by an /h/ was realized as its voiceless aspirated cognate. (I return to this type of realization in Chapter 7.)

This objection rests upon a fact which was true enough in the grammar of Middle Welsh. In Modern Welsh, however, the phonology is quite different. First of all, the alternations must be described with relation to the data available to the modern speaker of Welsh. Moreover, there is some evidence that some speakers have indeed established phonologies which reflect this synchronic analysis. As Watkins (1961:67--citing Fynes-Clinton 1913) points out, the adjective sad /sad/ 'firm', a modern borrowing from English, has the equative, comparative, and superlative forms sated /sated/, satach /satax/, and sataf /satav/, respectively.¹

There is one area of Middle Welsh which is of considerable importance to the nature of Modern Welsh. In Middle Welsh manuscripts, we do find occurrences of word-final p, t, and c (or k). At first glance, we should see two possibilities in the development of word-final stops. Either these stops were indeed voiceless aspirated stops or they were orthographic devices to represent an archiphoneme (in the sense of Trubetzkoy 1969).

If the first possibility is true (which is doubtful), then the minor rule 3.4 applies extensively in Modern Welsh. In almost every

case, where Middle Welsh orthography maintains a p, t, or c (or k) in word-final position, Modern Welsh maintains a b /b/, d /d/, or g /g/, respectively. In the few cases in which Modern Welsh orthography maintains the symbol for the voiceless aspirated stop in final position in words inherited from Middle Welsh, the stops occur in clusters with a sonorant, and in the colloquial dialects (excluding Standard North Welsh, Standard South Welsh, and of course, the Standard Welsh) the stops there are seldom pronounced at all. For example, the Standard phrase written maent hwy 'they are' is usually rendered /ma:ɪn n̪hu(ɨ)/ in speech.

The second possibility, that the Middle Welsh orthographic symbols represent archiphonemes, is the more probable explanation. According to Watkins (1961:79), Middle Welsh orthography used p, t, and c (or k) in word-final position to represent /b/, /d/, and /g/. Phonologically, there was no contrast (cyferbyniad) between the two classes of stops in word-final position. The implications of word-final position being a position of neutralization in Middle Welsh are quite important in our description of the consonant shift. The words inherited by Middle Welsh or borrowed during this period may have had word-final voiceless aspirated stops, but the nature of the archiphonemic neutralization of voice and aspiration in word-final stops would insure that voiceless aspirated stops in the inherited vocabulary and in borrowings would change to voiced unaspirated stops, in effect applying minor rule 3.4 throughout (as I point out below). Thus, through the development of word-final position as a position of neutralization in Middle Welsh, Modern Welsh actually began with the effect of the proposed consonant shift already firmly established in word-final position.

No matter which explanation we choose for the presence of word-final

symbols for the voiceless aspirated stops in Middle Welsh and their absence from Modern Welsh, the implications for the suggested consonant shift are the same. Modern Welsh began with word-final position failing to maintain contrast between voiceless aspirated and voiced unaspirated stops. The question remains, however, as to what has happened in word-final position since that time.

As we turn our attention to words which have come into Modern Welsh, we see that the neutralization process found in Middle Welsh has been (at least for a time) productive in the Modern Welsh period. This is particularly the case among the dentals and velars. For example, English velvet /velvet/ has been borrowed as melfed /melved/, racquet /ræket/ as raced /raked/, rocket /rokæt/ as roced /roked/, frock /frak/ as ffrog /frog/, and desk /desk/ as desg /desg/.² The fact that the labials do not appear to be affected does not diverge from the shift hypothesis, for, as we see in section 4.1, the generalization of a minor rule can follow a progression in time with respect to each position of articulation separately.

The fact that we have any application or generalization of the minor rule 3.4 (or at least, through neutralization, the effect of minor rule 3.4) in the Modern Welsh period can but converge on the notion that there is a sound change in this particular position in the word. To be sure, however, there are a few instances in which voiceless aspirated stops occur in word-final position. In some of these instances, the voiceless aspirated stop is found in free variation with a voiced unaspirated cognate. For example, the term celc /kelk/ 'concealment' alternates noncontrastively with celg /kelg/ (celc is borrowed from Irish), although the term is also realized with a suffix as celciad /kelkyad/ and as a

verb celcio /kelkyo/. Moreover, ffrog /frog/, mentioned above, can also be found as ffroc /frok/.

On the other hand, there are a few instances in Standard Welsh, in which words maintain the voiceless aspirated-voiced unaspirated contrast in word-final stops. For example, the English cab /cæb/ or cabin /cæbin/ has been borrowed by Welsh as caban /kaban/, with the truncated form cab /kab/; while English cap /cæp/ has been borrowed as cap /kap/ (also with the longer form capan /kapan/). The maintenance of contrast in word-final stops, however, is the exception rather than the rule.³

The issue of the maintenance of contrast in word-final stops brings up another problem--that of bilingualism. The chief source of new words in Welsh is English, as most of the Welsh-speakers also speak English, and English has been imposed upon the country especially through the education system (see W.R. Jones 1966). It could well be, then, that it is the speaker's knowledge of English which leads this speaker to maintain contrast in such pairs as cab /kab/ and cap /kap/, above. According to Professor T. Arwyn Watkins (personal communication), 'the phonological system of Welsh is nonproductive in Welsh, insofar as borrowings are concerned'.

This interrelationship between the maintenance of contrast in a supposed position of neutralization and the speaker's knowledge of English can be illustrated further by noting the phenomena associated with lenis initials in Welsh borrowings (see Griffen In press a). When a word is borrowed from English with an initial consonant which corresponds to one of those segments in the mutation system which occur as soft mutation forms but not as radicals (see Tables 1.0.a-b), this

segment eventually is changed to the corresponding radical form. Thus, we would expect initial /r/ eventually to be realized as /ɾ/ in environment I. As we see above, however, the terms raced /raked/ and roced /roked/, being fairly recent, have not yet undergone this change. Nonetheless, the final /t/ of the English words has become /d/ in the Welsh words. Now in these two words, the final consonant does not serve a distinctive function through its voice and unaspiration. In the term rhac /ɾak/ 'rack' (from the English), on the other hand, the initial segment has undergone the change to the radical but the voiceless aspirated stop is still maintained in word-final position probably because of the existence of a word rhag /ɾag/ 'lest'. Although there is certainly no prohibition in the Welsh language against homophony, I would contend that contrast is preserved through the speaker's knowledge of the English word and the English phonological system.

In this section, I have dealt at some length with the notion of archiphonemic neutralization of contrast. In spite of my attempt to incorporate the notions of contrast and neutralization of contrast into the generative model (see Griffen 1974a), these notions are not a part of generative phonology as it is presented in Chomsky and Halle 1968 or as it is usually practiced. In the current generative model, contrast has largely given way completely to the notion of distinctiveness, which operates in the systematic-phonemic realm of the phonological component. The manner in which we incorporate the effects of neutralization (as mentioned above) is through a rewrite rule carried out in the phonological component.

The rewrite rule which we would have to posit in the phonology in order to accommodate the phenomena noted in this section would change

all voiceless aspirated stops to their voiced unaspirated cognates. In other words, we would apply minor rule 3.4. Thus, insofar as our generative description is concerned (in which neutralization is handled by rewrite rule), the minor rule has indeed spread to word-final position. Moreover, as we see from most of the borrowings from the Modern Welsh period, the minor rule is in the process of generalizing.

5.2 Medial Positions and Clusters. As we direct our attention to intervocalic position, again we should consider the type of phonological strings inherited by Modern Welsh. As I mention in section 1.0, Brythonic and Latin voiceless stops were realized in the Old Welsh period as their voiced unaspirated cognates (Morris Jones 1913:161; Jackson 1953:553-7).

Although the intervocalic voicing rule is in fact the impetus (along with the loss of final syllables) for the development of the soft mutation rule, the environment for the application of this rule in Old Welsh is by no means limited to those environments which would develop into grammatically motivated soft mutation. To the contrary, the rule applies in Old Welsh purely on a phonological basis. Thus, we could not say that such a rule is parallel to soft mutation rule 1.1.a. Instead, it is identical to minor rule 3.4 (insofar as its application to voiceless aspirated stops is concerned).

As Modern Welsh inherited its vocabulary ultimately from Old Welsh, the impact of the Old Welsh rule upon Modern Welsh lies in the lexicon. Just as the Middle Welsh position of neutralization in word-final position (section 5.1) created a state in which Modern Welsh would have few if any word-final voiceless aspirated stops at the beginning of the

Modern Welsh period, the Old Welsh intervocalic voicing rule created a state in which both Middle Welsh and, through it, Modern Welsh would have few intervocalic voiceless aspirated stops.

Of course, as far as the actual progression of a shift in Modern Welsh is concerned, such phenomena as the Middle Welsh word-final neutralization and the Old Welsh intervocalic voicing do not converge upon the shift hypothesis directly. They do, however, converge indirectly by helping to create the effect of the shift. Such rules, then, serve to establish a conspiracy--a functional unity among several different rules (see Kisseberth 1970a). The fact that such a conspiracy exists over an extended period of time can only support the notion that a shift is taking place.

Although Modern Welsh does not have an intervocalic voicing rule, some intervocalic voicing is nonetheless evident. The Standard Welsh 'hard mutation' phenomenon requires that an adjective (with an underlying final voiceless aspirated stop) such as teg /teg/ (cited above) have its voiceless aspirated stop realized unchanged in intervocalic position, as in the equative teced /teked/.

There are some signs, however, that this system is changing. Mrs. Mona Pringle, of Gainesville, Florida, a native speaker of the Colwyn Bay area dialect of North Welsh, gives the equative form of teg /teg/ as teged /teged/. Now this is not Standard Welsh, but North Welsh is considered to be fairly conservative otherwise, and Mrs. Pringle does not, for instance, accept /j/ as an alternative form in soft mutation of /ç/ (see Griffen 1974b).

Moreover, as I mention in the previous section, while sad /sad/ 'firm' was noted as having the equative form sated /sated/ in data

collected early in this century, it is now more commonly heard as sadied /sadyed/. Likewise, other English loanwords seem to be affected in the same way. For example ffeind /fəind/ 'fine' has the equative form ffeindied /fəindyed/ (Watkins 1961:67). To be sure, this may be another case of interference through bilingualism, but the effect is interesting.

The loss of the 'hard mutation' alternation, as it affects colloquial Welsh, can certainly be attributed to analogy, from the fact that there is a voiced unaspirated stop in final position of the word, and hence in final position of the morpheme. The presence of such analogical leveling in a system which tends to voice final stops can be seen as further evidence of a tendency to replace medial voiceless aspirated stops with their voiced unaspirated cognates, at least where morpheme boundaries may be involved (as in the addition of adjective endings).

As we turn our attention to clusters, we find a wealth of corroborating evidence for such a shift occurring in Modern Welsh. According to Fynes-Clinton (1913:xxiii), Old and Middle Welsh combinations of voiceless aspirated stops (in pairs) are realized in Modern Welsh in one of two ways. If the second element of the stop cluster is a labial or a velar, this segment is voiced and unaspirated in Modern Welsh. If the second stop is a dental, it is realized as a voiceless unaspirated stop. In narrow phonetic terms, then, [pt] becomes [pɖ], [pk] becomes [pg], [tp] becomes [tb], [tk] becomes [tg], [kp] becomes [kb], and [kt] becomes [kd] (where the symbol for a voiceless stop represents voiceless aspirated, the symbol for a voiced stop represents voiced unaspirated, and the symbol for a voiced stop with a dot subscript represents

voiceless unaspirated).

Moreover, when a voiceless fricative precedes a voiceless aspirated stop in Old or Middle Welsh (Fynes-Clinton 1913:xxiii), the stop is realized as it is in stop clusters, above. If, however, the fricative is dental /θ/, the dental stop is not only unaspirated but also voiced. According to Bwrdd Gwybodau Celtaidd (1942:53), though, the dental stop is also voiced and unaspirated after the voiceless velar fricative /x/. Thus, the inheritance of Modern Welsh (at least from Early Modern Welsh) is such that there has been extensive voicing and even greater deaspiration in consonant clusters. As these processes have been carried out on a purely phonological basis, we can see here the further application of minor rule 3.4 in this new environment.

The productivity of the minor rule in consonant clusters can be seen in Modern Welsh borrowings from English. For example, English desk /dɛsk/ has been borrowed as /desɡ/, and English splendor /splendər/ has been borrowed as ysblander /(ə)sbländer/.

In order to add data on the productivity of minor rule 3.4 in consonant clusters in contemporary Welsh and determine its extent more accurately, I constructed an experiment using, among other items, a list of words found in Table 5.2.a. These were written in the standard orthography--the only difference between this and the phonological notation used herein is that c is used for /k/. Each was presented to an informant on a three-by-five card, and the informant read each word once slowly, syllable-by-syllable, and once quickly, as a single word. The responses were recorded on a Uher 4000 Report L.

Two informants are from the Bangor district studied in Fynes-Clinton 1913. Dr. Bedwyr L. Jones, Professor of Welsh at the University

College of North Wales (Bangor), comes from northern Anglesey (Môn), and Mr. Idris Roberts, on the staff of the same college, comes from Penrhyn, on the eastern outskirts of Bangor. Mr. Hugh Jones, a farmer from Bettws Garmon, speaks the Caernarvon district dialect. Mr. Merfyn Morgan, a researcher in the Department of Welsh at the University College of North Wales, comes from Newcastle-Emlyn in an area of Dyfed formerly known as Carmarthen. Dr. Jones was born in 1933, Mr. Roberts around 1914, Mr. Jones in 1902, and Mr. Morgan in 1947. In each case, the informant's parents were raised in the same region and taught their children Welsh as the primary language. Each informant feels that his speech represents the speech of his dialect area, each is bilingual in Welsh and English, and none was observed to have any speech impediments.

All informants could pronounce the voiceless aspirated stops and the voiced unaspirated stops intervocalically in various positions in the word. When the first three informants, those speaking North Welsh, recited the items in Table 5.2.a, none had any trouble with them, although they all recognized that some combinations were not found in Welsh.

With Mr. Morgan, on the other hand, I found a different situation. He recited the list without any changes when reading syllable-by-syllable. But when he recited the items quickly as words, the result was the list found in Table 5.2.b.

These results show a marked influence of the minor rule 3.4. It is not surprising to note that Mr. Morgan is from the same general region as the authors of Bowen and Rhys Jones 1960 (see section 4.1).

There is one troublesome point in the cluster phenomena treated in this section. Up to this point, we have only been concerned with

Table 5.2.a
Standard Orthography

happa	habda	hacba
hatta	habga	hacda
hacca	hadba	hacga
habba	habga	habpa
had-da	hagba	habta
hagga	hagda	habca
hapta	hapba	hadpa
hapca	hapda	hadta
hatpa	hagga	hadca
hatca	hatba	hagpa
hacpa	hatda	hagta
hacta	hatga	hagca

Table 5.2.b
Pronunciation by Merfyn Morgan (Newcastle-Emlyn)
Narrow Transcription

hapa	habda	hagba
hata	habga	hagda
haka	hadba	haga
haba	habga	haba
hada	hagba	habda
haga	hagda	habga
hapta	haba	hadba
hapka	hapda	hada
hadpa	hagga	hadka
hadga	hadba	hakba
hagba	hada	hagta
hakta	hatga	hagha

voiceless aspirated stops and voiced unaspirated stops. Now, however, we find voiceless unaspirated stops (*tenuis*). This new class of *tenuis* does not serve any distinctive function, so it can be relegated to the systematic phonetics as an allophone, or combinatory variant. As such, then, it must be derived from a phonological segment--either from the *aspiratae* or from the *mediae*. It is quite crucial to the arguments concerning us here that we determine whether the *tenuis* is a subclass of the *aspirata* or it is a subclass of the *media*, for if it is a subclass of the *media*, then the systematic phonemics of the phonological component must first derive these *mediae* from *aspiratae*--further evidence of the minor rule 3.4.

Now the *tenuis* differs from the *aspirata* in aspiration and from the *media* in voice. In order to show from which class this subclass is derived, it is therefore necessary first to determine whether it is the aspiration or the voice which serves the distinctive function in the phonology. As I demonstrate in detail in Chapter 7, it is the aspiration which is functionally distinctive (contrastive) in Welsh. Thus, the phonologically pertinent change in minor rule 3.4 is the change from aspirated to unaspirated; so in the case of the voiceless unaspirated stops (*tenuis*), the phonologically pertinent aspects of the minor rule have indeed applied, and any occurrence of such a stop is evidence of the spreading of the minor rule.⁴

Thus, the extent of application of minor rule 3.4 from Old Welsh to contemporary Modern Welsh in medial position and in consonant clusters can be seen to be fairly great. On the other hand, there are also some counter-processes working against the spread of minor rule 3.4. These are collectively known as 'provection' (see Morris Jones 1913:181-9;

Jackson 1953:561-5). In Chapter 9, I treat some of the phenomena classified under provection in an hierarchical framework. In the generative framework at this point, however, it is enough to say that provection does not block the application of minor rule 3.4; so, in the light of the requisites for proof given in section 5.0, the minor rule is indeed spreading in this environment.

5.3 Initial Position. The first evidence for the proposed consonant shift in initial position is that developed in Chapters 3 and 4. In the case of the deviation in the mutation system represented by gan /gan/, I ought to stress one important fact. Although the minor rule 3.4 has indeed brought about an historical change in the language in the case of the deviation, the change has not affected the underlying representation of the words affected.

In the generative model, the fact that the underlying form of, for example, gan /gan/ is |kan| and the fact that this underlying form is the same as that extant in the description of the language before the change demonstrate that we have here not a change in lexical item, but a change in the phonological rules employed in the grammar (the description of the language). Such a change not reflected in the lexicon creates a dilemma. As the underlying segment must be a |k| in order to derive the mutation variants in the appropriate environments, on this underlying level there must be a |k| distinct from |g|. On the other hand, there is no functional distinction in the affected words between /k/ and /g/ (and likewise for the labials and dentals).

This property by which distinctiveness is maintained on the underlying level but absent on the phonological level is known as

neutralization. Insofar as the neutralization in the affected classes of words takes place in all environments, what we have is absolute neutralization, which I mention in section 3.3 (see also Kiparsky 1973).

Taking this absolute neutralization and the existence of the underlying voiceless aspirated stop into consideration, we might well ask just what the criteria are for determining a consonant shift. Is there to be a loss of distinctiveness in the underlying level which motivates the phonology and produces the acoustic data, or is a change in the acoustic data which reflects loss of functional contrast sufficient? On the one hand, the notion that phonological change is a reflection of sound (acoustic) change (as I point out in sections 4.0 and 5.0) would tend to support the latter condition; while, on the other hand, the fact that phonological (though functional) contrast (as opposed to underlying distinctiveness) is not accepted in most approaches to generative phonological theory would tend to discredit the latter condition, supporting indirectly the former.

Due to the formal nature of generative phonology, the question of the effect of neutralization on the type of change reflected by the deviation is moot. As I state in section 5.0, only two conditions are needed to show that a shift is progressing--the existence of a minor rule and the generalization of the minor rule. It is sufficient therefore to point out that the minor rule exists in this environment and that it is generalizing in this environment to more and more items. This I have demonstrated in Chapters 3 and 4. The question remains, of course, as to whether such a model which relies upon the formal device of the rewrite rule can adequately predict the existence of an on-going consonant shift.⁵ I return to this question in Chapter 6.

The type of change outlined above in which the underlying segment remains intact while the phonological rules change is just one type of change that can occur in initial position (see section 4.0). This type of change I label the gan-type change, for the sake of convenience.

The gan-type change has an antithesis, in which the underlying segment changes while the phonological rules remain intact. This type of change is known as relexicalization (the restructuring of section 4.0 carried out in a particular lexical item). In relexicalization, the minor rule applies, and the speaker, hearing the deviant form in environment I, reclassifies the output of the minor rule as the lexical item itself. In order for relexicalization to converge on the shift hypothesis, it must be carried out such that a segment which was formerly a voiceless aspirated stop has changed to a voiced unaspirated stop in initial position.

As the gan-type change affects the rather limited class of function words, we might expect any relexicalization to affect the unlimited class of content words. As far as Standard Welsh is concerned, there have been very few changes at all in word-initial position among consonants since Middle Welsh. In the colloquial dialects, however, some changes have taken place parallel to the minor rule 3.4.

According to Professor Herbert Pilch (personal communication), in the dialect of Cardigan (now part of Dyfed), some words beginning in Standard Welsh with voiceless aspirated stops and taking the mutations of voiceless aspirated stops are found in the unmarked environment with the corresponding voiced unaspirated stops and the mutations of the voiced unaspirated stops. As an example, Professor Pilch cites the word pobl /pobl/ 'people'. In Standard Welsh, the word pobl /pobl/

alternates in soft mutation with bobl /bo~~b~~l/. In this dialect, however, the word is bo~~b~~l /bo~~b~~l/ (pronounced [bobol] after epenthesis), and it has the soft mutation form fobl /vo~~b~~l/. I refer to such a change as a pobl-type change, for the sake of convenience.

The first thing that should strike us as we consider the pobl-type change in the Cardigan dialect is the fact that this change is not very extensive--affecting only a few words in one dialect and rare elsewhere. Nonetheless, in order for the relexicalization to take place, the voiceless aspirated stops had to become voiced unaspirated stops. Thus, the minor rule 3.4 has indeed applied. Inasmuch as the rule did not previously apply in earlier forms of the language, the application of the minor rule can be seen as a generalization from previous environments. The same phenomenon can be seen in the Bangor dialect, as described in Fynes-Clinton 1913. For example, cingroen /kingro:ɪn/ 'stinkhorn' has the alternative forms [kingron] and [gingron], and piogen /pyogen/ 'magpie' has the alternative forms [pyogan] and [byogan].

There is an example of the pobl-type change in Standard Welsh. According to Fowkes 1949 (and Fynes-Clinton 1913), the English word gooseberries had been borrowed into Welsh as cwsberins /kusberins/. According to Evans and Thomas 1968, however, the word is now gwsberys /gusberis/--a clear application of minor rule 3.4 and capable of being described as relexicalization. In the light of the effects of bilingualism on the Welsh language (see section 5.1), attributing such a change to a shift in the language may be going a bit too far.

The evidence for the pobl-type change being an integral part of a consonant shift in progress in Modern Welsh is, indeed, weak. On the other hand, we have a few cases of relexicalization that parallel

the minor rule 3.4. We add to this a change (though it may well be widespread) which is indicative of the minor rule but which is more indicative of the effects of an ever-growing influence from English. We may indeed ask whether such evidence is even admissible.

The reason for the uncertainty over the admissibility of the pobl-type changes in Modern Welsh as evidence for a consonant shift lies in the area of purpose. Although the two requisites for determining the existence of a consonant shift are both met with regard to the pobl-type change, it nonetheless appears as though these occurrences have nothing to do with the shift, but reflect other conditions in the language (including the 'conditions' of random change). This matter is treated further in Chapter 6.

The final piece of evidence for a consonant shift in progress in Modern Welsh can be found in the dialect of Tŷ Ddewi in the area of Dyfed formerly known as Pembroke. According to R.O. Jones (1971:169), the nasal mutation in the dialect of Tŷ Ddewi has been lost over the course of three generations. In the older generation of Welsh-speakers in Tŷ Ddewi, we find the nasal mutation applying as it is in Standard Welsh (see Tables 1.0.a-b). The middle generation, however, has lost the voiceless aspirated nasals from the mutation system and has replaced them with their voiced unaspirated cognates. This change is by no means unique to the speakers of the Tŷ Ddewi dialect. The most interesting development takes place in the speech of the younger generation. These speakers have completely lost the nasal mutation, so that /b/, /d/, and /g/ are realized in the nasal mutation environment III as the radicals /b/, /d/, and /g/, respectively. However, /p/, /t/, and /k/ are realized in environment III not as the radicals, but as /b/, /d/, and

/g/, respectively.

Now as far as the voiceless aspirated stops are concerned, we could say that for the younger generation of speakers environment III has merged with environment II, and the realization of the voiced unaspirated stops is a result of the soft mutation rule 1.1.a. Given, however, the totality of the environments, according to which a given item must be in one of the mutation environments at any time, as shown in section 2.8, we cannot accept such a solution. Even in those cases in which two environments appear to coexist such that soft mutation applies to some segments and spirant mutation to others, as in section 2.6, a 'bleeding' relationship can be established between the application of the rules, and such a relationship cannot be established between environment I and environment II in this case.

In the generative approach to historical linguistics, if a rule is lost from the grammar and if that rule derived a surface phonological segment from an underlying segment, then the underlying segment must be realized (compare King 1969:46-51; Kiparsky 1971:627-30). Thus, if the nasal mutation rule 1.2.a is lost in the Tŷ Ddewi dialect, then the voiceless aspirated stops must appear on the surface. They do not. Thus, it is necessary for us to posit a rule turning the underlying voiceless aspirated stops into their voiced unaspirated cognates. Such a rule is minor rule 3.4.

At least from the generative standpoint, this last piece of evidence is quite compelling. It is an indication that, in a position of instability where a rule is lost requiring the surfacing of the underlying segment, the minor rule intervenes. The implication of such a development is that any addition to environment I is going to motivate

the change exemplified by minor rule 3.4. Considering the nature of the mutation system environments as outlined in section 2.8, such a development as that mentioned above can only give impetus to a consonant shift.

In this section, I have drawn evidence from three phenomena in word-initial position for the concept of a consonant shift developing around minor rule 3.4. Although the notion of the pobl-type change (relexicalization) may not be very strong, the evidence afforded by the gan-type change and by rule loss in the Tŷ Ddewi dialect is quite strong from a generative point of view. Any evidence with the least amount of credibility, moreover, is especially persuasive if it occurs in word-initial position. The reason for this is the stabilizing influence of the mutation system. In order to maintain grammatical information within this system of initial consonant gradation, contrast (if not distinctiveness) must also be maintained between the voiceless aspirated stops and the voiced unaspirated stops.

5.4 Quod Erat Demonstrandum. In this chapter, I have set out to prove that a consonant shift is progressing in Modern Welsh. In order to prove this, two conditions should have been met--to show that the minor rule 3.4, a single rule changing an entire natural class, is a necessary part of a description of Modern Welsh, and to show that minor rule 3.4 has indeed been generalizing in different environments over a period of time.

I have presented the evidence in three parts, paralleling the three positions within the word. In final position, we find a position of neutralization which historically has acted in accordance with

minor rule 3.4 to change all voiceless aspirated stops to voiced unaspirated stops. As we see from some fairly recent borrowings, moreover, where the effects of bilingualism are minimal, the minor rule is productive in this position. Thus, the minor rule exists and is generalizing in word-final position.

In medial position, we find that borrowings from English which at one time adhered to the 'hard mutation' system no longer do so. A change can further be seen in at least one dialect in which the voiceless aspirated stops in medial position in adjectives have changed likewise to voiced unaspirated stops. Furthermore, in clusters, we find a large number of instances in which historically voiceless aspirated stops have become voiced unaspirated stops phonologically (although some become voiceless unaspirated stops phonetically). Such changes are not only evident in the transition from Middle Welsh to Modern Welsh, but are also found in Modern Welsh dialects. Thus, in medial position and in clusters, the minor rule exists and is generalizing.

Finally, in initial position, we find the gan-type change which (as shown in section 4.1) is generalizing today. The pobl-type change, moreover, shows the evidence of the minor rule 3.4 and is a factor which constantly changes. In the loss of the nasal mutation rule in Tŷ Ddewi, we find the application of the minor rule generalizing in the younger generation of speakers. Thus, in initial position, too, the minor rule exists and is generalizing.

It would appear, then, as though the conditions for a consonant shift along the lines of the minor rule 3.4 with an unrestricted environment have indeed been met. Insofar as these requisites are both necessary and sufficient in the generative model to prove the existence

of an on-going consonant shift, I should submit that the shift is occurring.

Yet, in spite of the fact that I have proven the existence of a consonant shift, I have not proven that there is a change occurring in the Welsh language. All that I have shown is that a consonant shift is in progress in the generative description of Modern Welsh. If the generative description of Modern Welsh is indeed adequate in all respects, then we can say that there is, in fact, a shift occurring in the language itself. I address the adequacy of the generative description of Modern Welsh in the next chapter.

NOTES TO CHAPTER 5

¹To be sure, these are more usually heard as sadied /sadyed/, etc., today, a point to which I return in the next section. The word is borrowed from Scot and Northern English dialects, as in the term 'sad bread' (Fynes-Clinton 1913:470-1).

²I return to this particular problem in the next section.

³Professor Herbert Pilch (personal communication) offered only two for the colloquial dialect of Cardigan (now Dyfed)--twp /tup/ 'stupid' and gwep /gwep/ 'grimace'.

⁴Within the framework of generative phonology, such an argument is vague. This vagueness, however, should be cleared up in Chapter 7.

⁵This is not to claim that other phonological theories without the rewrite rule can achieve this goal either.

CHAPTER 6 PROBLEMS OF DESCRIPTION

6.0 Problems in the Generative Description. As pointed out in section 5.0, actual sound change ought not to be confused with the conventionalized description of sound change, be it in the generative model or in any other model of linguistic description. There is always a danger in a linguistic description of confusing the logical notion of validity with actual reliability.

Insofar as the description and arguments of the past five chapters are internally consistent and they relate the premises (the aspects or hypotheses of the generative framework) to the observations about the Welsh language, our generative description is quite consistent. But is it reliable? This is important, for if the generative description is not reliable, then we cannot infer from the consistence of the framework that there is even such a thing as the new Welsh consonant shift. Without establishing the reliability of the framework, then, we cannot conclude anything about the language being described--only about the framework being used.

In order to establish the reliability of the framework in the description of Welsh in general and the consonant shift in particular, we must demonstrate that those aspects of the framework which directly (or, indeed, indirectly) affect our proof are, in fact, adequate. As the reliability of the system depends upon the total affect of all pertinent aspects of the system, a single inadequacy will result in

the reliability of the framework, insofar as the shift is concerned, being discounted. In such an event, the conclusions of the description may very well stand, but the framework must be changed before those conclusions can be drawn from the generative model.

Considering the importance of assuring reliability in any description of a language event, we should at this point look back upon the description and arguments presented in the generative model in order to determine whether there might be any inadequacies which could endanger the conclusions reached in Chapter 5. Of course, any such inadequacies must be corrected either within the generative model or in some subsequent model of linguistic description.

The first inadequacy which I should like to address concerns one of the most basic notions of a generative description--a generative description must be formal and explicit (see Lyons 1968:136-7). In itself, such a requirement is hardly objectionable, but if the description relies upon notions which are not formal and explicit, then there is not only an inadequacy in the description, but an inconsistency.

The explicit formalism of generative phonology in the description of historical linguistics is limited to the rewrite rule.¹ The establishment of the consonant shift in the generative description, as outlined in the previous two chapters, is predicated upon the development and generalization of a minor rule changing one natural class of segments into another natural class. Indeed, the change itself can be described as a change from one rewrite rule to another.

Now the question becomes 'How do we check the reliability of these rules?' According to Chomsky (1965:12), the output of the grammar is judged in accordance with 'global' considerations. Although it is

nowhere stated what these 'global' considerations are, I would assume that they consist of several conventions. The first convention is the specification of the environment of the rule such that it applies only to those segments which are to be affected. When two or more rules could be applied in a given situation, however, we must rely on notions of rule ordering. Such conventions as the noniterative rule convention, transitivity of application, and asymmetrical application of rules are used in Chomsky and Halle 1968 in order to maintain linear ordering (even within instances of cyclical ordering), so that the output of one rule is the input of the next in an orderly progression. Other devices include the notion of maximal application (Kiparsky 1968), local ordering (S. Anderson 1969), and derivational constraints (Kisseberth 1970b; Shibatani 1973).

The minor rule, as it is developed in Chapters 3, 4, and 5, adheres to all of the pertinent conventions of phonological description in the generative model. As such, it is consistent with the system. However, can such a notion as the minor rule, consistent as it may be with the rest of the description, be reliable enough to support our conclusions?

The minor rule may well be too powerful due to the requirement of a formal and explicit description. This can be illustrated with the following hypothetical example. Suppose that in Old Welsh, nine words changed such that each member of a natural class of voiceless aspirated stops became voiced and unaspirated. Suppose further that the same thing happened in Middle Welsh and the same in Modern Welsh. If all we have to establish the existence of a consonant shift in Welsh is the development and generalization of a minor rule, then we would have

to conclude that a shift is in progress. Of course, any linguist who would suggest a consonant shift on the basis of so few forms would be ridiculed. But here we are relying upon the judgment of the linguist. If we are to maintain in practice the requirement that the description be formal and explicit, then we must supply a formal and explicit device for comparing one set of rewrite rules with the rest. So long as we do not have such a device and the linguist must rely upon common sense in the derivations of the phonological component, then the requirement that the description be formal and explicit is best ignored. Ignoring the requirement, however, is only going to establish an inconsistency in the generative model--an inconsistency which can be remedied only by either providing the necessary formalism or withdrawing the requirement.²

Another problem in the description concerns the notion of contrast. Distinctiveness is a given factor in the lexical items, which, with their distinctive phonological specifications, are presented to the phonological component for interpretation (application of phonological rewrite rules).³ In the phonological component, the lexical items become the underlying strings. This creates a distinct level. The phonological rules then apply in order to derive the phonetic data. This derivation is direct, with no intermediate level (for discussion, see Lockwood 1975).

In this respect, my description over the previous five chapters is not at all typical of the generative school, for I have recognized three levels--the underlying level, the phonological level, and the phonetic level. In so doing, I follow Schane 1973, though that work is also atypical of this school in this respect (see also Griffen 1974a).

According to the tenets of generative theory, as set down in Chomsky and Halle 1968, there is no intermediate level. This state was

established as early as Halle 1959, and in an answer to Householder 1965, Chomsky and Halle 1965 attacks the notion of an intermediate 'phonemic' level outright. In effect, the disestablishment of the phonemic level (which had been religiously maintained in American structuralism) meant that the system would not only be simplified, but it would also lose the notion of (functional) contrast within the phonology.

The loss of the notion of contrast in generative phonology is important to the matter at hand, and we ought to consider the effect of this loss. Distinctiveness serves to differentiate segments in classes on the underlying level, while contrast does the same on the phonological level. By eliminating the phonological level of contrast, the generative theorist holds that simplicity is afforded at no cost, for the rewrite rules are fully specified and act upon feature specifications found on the underlying level. Thus, it is maintained, there is no need in the structure to add a redundant level at which contrast is reestablished (compare the derivation axiom in Lockwood 1975).

In language change, however, there is definitely a need for some determination of contrast less abstract than the underlying level. In fact, this notion of contrast is central to the use of the minor rule in the deviation. As we see in the synchronic situation in Chapter 3 and the diachronic situation in Chapter 4, the underlying initial segment of gan /gan/, for example, is |k|. This is quite evident from the mutation forms. After the minor rule 3.4 applies, though, the initial segment becomes /g/. As we look at this situation from its historical viewpoint, we note that the underlying segment is still maintaining distinctiveness. So what has changed? In the generative model without contrast, we must say that a rule has changed, but we

cannot say what the effect of this change has been. Without contrast, we cannot interpret the change as a shift in consonants--only as an addition of a rule.

Moreover, in the synchronic description, where (in section 5.2) cluster phenomena create a voiceless unaspirated stop (*tenuis*), without a level of contrast the rule devoicing the phonological segment applies at the same level of the phonology as the minor rule. This makes it impossible to differentiate between a change of phonological pertinence and one of phonetic pertinence (in the manner of the Prague school). In such a system, a rule in the derivation applied because of the physiological limitations of the articulatory apparatus is just as grammatically-oriented as a mutation rule. Although such a practice may be adequate, it is hardly appropriate for achieving insights.

A further criticism of the system is that it lacks any kind of teleological principle (see Jakobson 1962:1-2). Such a principle would indicate how a language is changing or could change given certain conditions within the language. It would establish goals of language change and classify changes within the language with reference to these goals. (Compare, for example, Waleh 1975 and the 'panchronic' approach.)

One could object to this criticism by pointing out that the minor rule and its generalization describe conditions of language change and the goals of this change. But they do not for several reasons. First of all, a generative description must be formal and must be explicit. The informal and inexplicit description of goal stated above could not be incorporated into a generative grammar. Moreover, if we were to attempt to include such a statement of goal into a generative grammar, we would find that the statement may lend itself to a logical implication

(hypothesis), but it is unsuited to current formalism.

As mentioned in section 5.3, there is an attempt in generative theory to accommodate some form of teleological principle. This is found in the markedness conventions of Chomsky and Halle (1968:Chapter 9). I treat this attempt in section 6.2.

6.1 The Inconsistencies of Soft Mutation. One of the major problems in any generative analysis of Modern Welsh lies in the treatment of soft mutation. As stated in Chapter 1 and Chapter 2, there are two sides to the mutation system--the phonological side and the grammatical side. Now in nasal mutation and spirant mutation, we find two finite sets of grammatical environments each motivating a phonological rule (or set of rules, if we wish to maintain a distinction between the two classes of stops in nasal mutation) which represents one particular phonological process. On the other hand, the soft mutation adds an element of irregularity to the otherwise regular system.

In section 2.2, I outline the environments which (according to the generative approach) motivate the various soft mutation rules. Throughout Chapter 2, I emphasize that whenever a mutation environment exists and the initial segment that falls into this environment is one of those segments noted in Chapter 1 as undergoing the particular rule, then the rule must apply. Although, as we see in section 2.6, some underlying segments may escape the application of soft mutation due to the bleeding relationship found between environment IV and environment II, a segment which can undergo soft mutation and which is not covered by a counter-example or exception (section 3.0) must undergo soft mutation, regardless of whether this segment is supposed to undergo rule 1.1.a, 1.1.b, 1.1.c,

1.1.d, or 1.1.e.

Soft mutation, then, is a single process, which applies in a specified environment. As we see in section 1.1, however, in spite of the fact that soft mutation is a single process, it is represented in the phonological side of mutation as five separate processes. I do not wish to contest the notion that with some extremely complex phonological rule, we could not use the generative notational devices (such as angled brackets) in such a way as to collapse the five soft mutation rules as they are presented in Chapter 1. I would contest any notion, however, that would contend that by collapsing these five rules into one, we have collapsed five processes into one process.

The soft mutation rules 1.1.a-e represent the following processes: voicing and deaspiration; continuance; deletion; denasalization, continuance, and desonorization; and voicing, deaspiration, vocalization, and sonorization. If one were to argue that by collapsing a rule we collapse the processes, then one would have to contend that, for example, voicing is in reality the same process as continuance, and that four of these processes share the same 'meta-process' as deletion. In the generative feature system as stated in Chomsky and Halle (1968:Chapter 7), I do not believe that such an argument could be defended.

In soft mutation rules 1.1.d and 1.1.e, moreover, we find a logical problem with any attempt to classify soft mutation as a single phonological process. In rule 1.1.d, the affected segment takes on the specification [+obstruent] (desonorization); while in rule 1.1.e, the affected class takes on the specification [-obstruent] (sonorization). In the binary feature specification system currently used in generative phonology, it would be difficult to maintain that a morphophonological

process (neither assimilative nor dissimilative) could produce the opposite specifications at one time.³

The problem in soft mutation is that we have one grammatical process reflected in several phonological processes, a situation conspicuously absent from the other mutations. There is something inherently counter-intuitive about this situation. Indeed, traditionally Welsh grammarians have considered the grammatical process of soft mutation to correspond to the single phonological process known as 'lenition' (see, for example, Jackson 1953:543-60). The question immediately comes to mind as to why generative theoreticians do not use such a feature.

Generative phonology has developed from a foundation constructed by two principles: the phonetic feature and the binary specification. The features of generative phonology have been inherited from the American structuralist school and the Prague school. The features themselves have always been based upon phonetic correlates in accordance with the 'inner approach' to phonology of Jakobson and Halle 1962, though their substance has changed from acoustic (in Jakobson, Fant, and Halle 1952; Jakobson and Halle 1962) to articulatory (in Chomsky and Halle 1968).

The binary nature of feature specifications was first formally established in Cherry, Halle, and Jakobson 1953. This system has maintained its basis in mathematical logic throughout its development. The only modifications of the basic binary system have occurred in Halle 1959, in which the zero specification is disestablished (and with it contrast--the function was replaced by morpheme structure rules), and in Chomsky and Halle 1968, in which notions of markedness and the M and U

specifications are introduced (see section 6.2).

According to Cherry, Halle, and Jakobson 1953, gradual features (those with degrees of presence rather than presence versus absence--compare the gradual versus the privative opposition of Trubetzkoy 1969) can be described through other, binary features. This practice maintains the phonetic orientation of the features as well as the mathematical nature of the description.

Leaving the generative approach aside for the moment, let us consider the fortis lenis scale as it appears in Table 6.1 (compare Griffen In press a). In this scale, the lenis-most column is on the left, and the columns progress in strength to the right. In such a scale of gradual oppositions, soft mutation consists of lenition--the loss of one degree--in columns 2 and 3.

Table 6.1
The Fortis-Lenis Scale

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
v	b (m)	p	f
ð	d	t	θ
-	g	k	x
l	ɭ		
r	ɣ		

Unlike the generative approach, such a scale maintains a single phonological process parallel to a single grammatical process (soft mutation). Such a system of strength has been suggested in Foley 1970a and 1970b. The orientation of Foley's strength system, however, is not phonetic, but purely structural. This is to say that there is no phonetic process underlying the rule. What Foley has done has been to

note the manner in which change occurs and alternations occur in languages and develop these into patterns. As such, then, it is tautological.

The gradual oppositions embodied in the strength scales of Foley 1970a and 1970b are inappropriate in generative phonology, inasmuch as the orientation of these scales is structural rather than phonetic. The 'inner approach' of Jakobson and Halle 1962 is a basic tenet of the theory.

As demonstrated in Hooper (1973:Chapter 8), the gradual opposition along fortis-lenis lines may have phonetic correlates. Moreover, in the subsequent chapters in this work, I give further phonetic evidence for the fortis-lenis gradual opposition. The establishment of phonetic correlates, however, only satisfies one of the two principles in the foundations of generative phonology.

Still to be accommodated is the principle of the binary nature of features. If we consider Table 6.1, we can see that elements of column 2 alternate in soft mutation with the corresponding elements of column 1. If this were all that is involved in soft mutation, then the system could be accommodated in binary features--column 2 could be plus and column 1 could be minus the feature [fortis]. Unfortunately, elements of column 3 alternate in soft mutation with the same elements in column 2 which alternate with elements in column 1. Such a situation eliminates any effective accommodation between the fortis-lenis scale and the binary features of generative phonology.

Because of the impossibility of accommodating the fortis-lenis scale with the binary feature system, we are forced into the situation in which, following Cherry, Halle, and Jakobson 1953, the gradual

opposition must be expressed through other, binary features. Thus, although there is certainly a single phonological process (the process of lenition) reflecting the single grammatical process of soft mutation; in the generative model, we must describe the single grammatical process as corresponding to five disparate and even contradictory processes.

In the past five chapters, I have used the binary features of Chomsky and Halle 1968 and have been able to describe all of the phonological rules, even those of soft mutation. It is not a question, then, of the binary system of generative phonology being adequate. The question is whether such a system is appropriate for the description of Welsh.

I would contend that the generative phonological description of Welsh is inappropriate, for it is contradictory. The reason that a phonetic orientation is used for the features of generative phonology is that such an orientation is natural. It maintains a link with the real world of observable data. Indeed, it is the appeal to this real world, through the findings of experimental phonetics in motor theory (for example, Halle and Stevens 1964), that compels Chomsky and Halle 1968 to adopt the articulatory substance for the features over the acoustic.

On the other hand, the requirement that the features adhere to some preconceived notion of two-valued mathematical logic (that is, the system of binary specifications) is hardly in accord with the requirement that the features themselves have natural phonetic correlates. If it is so important that the features themselves be dictated by observable phonetic data, then it should be of equal importance that the specification of these features reflect the behavior of natural languages (or, at least, of the natural language being described--Welsh).

Of course, I have been concerned here with the use of generative phonology for the description of Welsh. As far as theory is concerned, however, such a basic inconsistency as that found in the phonetic orientation versus the mathematic-logical nature constitutes far more than an inappropriateness in theory construction. It constitutes a flaw, making binarity inappropriate to the object of description, and the model necessarily inadequate.

As in the previous section, we may ask whether the inappropriateness of generative phonology in this respect can be remedied. Any remedy that would result in a generative description of Welsh would have to accommodate the gradual opposition. This can be accomplished by substituting numbers for plusses and minuses in the rewrite rules (compare the manner in which Schane 1973 employs numbers in the systematic phonetics). Such a rewrite rule could be posited as follows:

$${}_1\left\{\begin{array}{l} 2 \text{ fortis} \\ 3 \text{ fortis} \end{array}\right\}_1 \rightarrow {}_1\left\{\begin{array}{l} 1 \text{ fortis} \\ 2 \text{ fortis} \end{array}\right\}_1$$

The fact that the rewrite rule can be adjusted so as to accommodate the gradual opposition is a positive development in generative phonology. Such a development, though, cannot overcome the inadequacies discussed in the previous section.

6.2 Markedness and the Minor Rule. The notion of markedness is mentioned in section 6.0 as somehow relating to a teleological principle. The generative version of markedness creates a problem for the description presented of such magnitude that I treat it here in a separate section.

To understand the generative version of markedness, it is necessary

first to consider the Prague concept as it was developed during the classical Prague period (1929-1939) and as it is described in Trubetzkoy 1969. The oppositions of the Prague school correspond to the features of the generative, in that they maintain a phonetic orientation and serve as the basis of the phonology. The Prague oppositions, however, are not necessarily binary, but are considered to be 'strong' or 'weak' in any phoneme. In privative oppositions, strength is presence and weakness absence, but in gradual oppositions, there are degrees of presence, or strength.

In any Prague opposition, strength is proportional to the deviation from the natural state of breathing. Hence, as breathing is voiceless, in the correlation (that is, the privative opposition) of voice, the voiced member is the strong opposition member and the voiceless member is the weak opposition member. Similarly, in the correlation of tension, as breathing is lax, the fortis member is the strong opposition member, and in the correlation of aspiration the strong opposition member is the aspirated member.

In such a system, markedness is strongly correlated to the notion of naturalness (see Trubetzkoy 1969:146). If in a given phoneme the strong (or a stronger) opposition member is present, then that phoneme is marked for that opposition. If the weak (or a weaker) opposition member is present in a phoneme, then that phoneme is unmarked with respect to that opposition. Thus, a phoneme which is voiceless is unmarked for voice, and one which is voiced is marked for voice. To be sure, this situation in relation to voice is contradicted in Trubetzkoy (1969:146), but as this one reference contradicts the author's own notion of markedness as well as other references in his book, this

contradiction may be an error which would have been corrected had Trubetzkoy lived to complete the work. Whether a contradiction or not, however, Trubetzkoy (1969:146) goes on to note that in the final analysis just what is considered strong and weak in a particular opposition (and through this, what is considered marked and unmarked) can only be determined by the functional structure of the particular phonemic system under study.

This last point is crucial in understanding the Prague approach to markedness (indeed to phonology as a whole). Each language constructs its own system of functional relationships, and a particular language can only be judged with reference to its own phonological system. The oppositions in one language (in the Prague approach) may be of an entirely different nature from the corresponding oppositions in another. Thus, aspiration may be a (phonetic) privative opposition (correlation) in English but a gradual opposition in Welsh (compare Kim 1965 on Korean).

Now in historical linguistics, the notion of markedness is quite important. If one phoneme (in the Prague sense) changes to another along the lines of a particular opposition (for example, voiced to voiceless) which is phonologically pertinent (relevant), then we would expect the change to take place such that the marked opposition member gives way to the unmarked opposition member. This notion hinges on the distinction between phonologically pertinent oppositions and phonetically pertinent oppositions.

The phonologically pertinent opposition (with reference to two oppositions) is the opposition which can be used to predict the member of the phonetically pertinent opposition. Thus, those oppositions of

phonetic pertinence only can be predicted by those of phonological pertinence (the 'phonemic' oppositions). The precise relationship is determined by the functional structure of the phonology of the particular language.

The generative approach to markedness is descendent from the Prague approach with some important differences. First of all, in generative phonology there are no notions of strength or weakness, nor of gradual presence. As I mention in the previous section, all feature relationships must be binary--implying the presence or the absence of a particular feature.

Not only are the relationships between feature specifications to be described in one particular way (binary) for all features, but the features themselves come from a finite set (see Chomsky and Halle 1968:Chapter 7; compare also Sampson 1974). As I mention in section 5.0, this finite set of features is meant to be universal. A feature in one language is precisely the same as the corresponding feature in any other, at least insofar as the phonological rules are concerned--the systematic phonetics may realize degrees of presence.

The notion of systematic phonemics, which must be specified using binary features only, versus systematic phonetics, which allows various degrees of realization depending upon language, may at first glance appear to be similar to the Prague notion of phonological pertinence versus phonetic pertinence. As I point out in section 6.0, however, whereas the rewrite rule is the sole operator and whereas there is no phonological level of contrast between the systematic phonemes (underlying segments) and the acoustic signal, any attempt to draw a division between the phonology and the phonetics at all similar to the 'principium

divisionis' of Jakobson (1962:23) must necessarily be inadequate, for it would contradict the basic theoretical and descriptive tenets of generative phonology.

Assuming that some sort of phonological-versus-phonetic division could be made (as practiced by Schane 1973 and in this treatment of Welsh), notions of markedness would occur in the phonology (systematic phonemics). As such, then, a generative approach to markedness would be necessarily binary due to the binary nature of the systematic phonemics. Examination of Chomsky and Halle (1968:Chapter 9) reveals that it is.

Perhaps the most crucial difference between the Prague and generative notions of markedness lies in the two approaches to phonological systems as members of the universe. On the one hand, the Prague approach holds that each language is judged by its own system of functional relationships. On the other hand, the generative approach maintains a universal base underlying all phonological systems (indeed, all linguistic systems).

The universal base of generative phonology is reflected in its concept of markedness. Just as a particular feature is specified without regard to the operation of the phonological system of which it is a part, a segment is considered to be marked or unmarked on the basis of a universal set of interpretive conventions. These universal interpretive conventions determine what is marked and what is unmarked in Language.

As in the Prague approach, the generative notion of markedness contends that in cases of historical change, the change of one segment to another reflects a change from marked to unmarked. In keeping with the formally explicit nature of generative phonology, the manner of change is not only stated in the universal interpretive conventions themselves, but also through 'linking rules' which serve to preserve the

unmarkedness of the new segment. The inference to be drawn from the notions that markedness is necessarily universal and that change necessarily reflects markedness is that change occurs along the lines of universal tendencies.

Returning once more to the changes in the Welsh consonant system, whether there is an on-going consonant shift or not, there has certainly been a consistent (from at least one point of view) change in some cases from a voiceless aspirated stop to a voiced unaspirated stop. The change, moreover, can be represented in generative terms in the form of the minor rule 3.4 (at least phonologically).

Inasmuch as the markedness conventions represent universal tendencies in language change and as such serve as a teleological principle predicting the manner of change, the change represented by minor rule 3.4 ought to be reflected in the markedness conventions. Let us therefore apply the markedness conventions of Chomsky and Halle (1968:404-7) to the minor rule.

Aspiration (the heightened subglottal pressure of Chomsky and Halle 1968) is not covered in the markedness conventions. Indeed, it is usually considered to be a redundant feature. If we examine the specifications in Table 1.0.c, moreover, we find that it is indeed redundant with regard to the feature voice. Thus, we can conclude that determining the markedness of voice must precede aspiration, which can be determined by some subsequent linking rule.

Turning our attention to voice, we find that in order to determine the marking of voice from convention (XXI), we must first determine the specification of sonorance. Looking up the affected segments in Table 1.0.c, we find that all stops are specified [+obstruent]. Thus, the

affected segments are [-sonorant]. Applying convention (XXI) now, we find that the unmarked specification for voice in a segment which is specified [-sonorant] is [-voiced].

Taking the markedness information into consideration, we return to the minor rule and find that the segment specified [-voiced] is changing to [+voiced]. Thus, the unmarked segment is changing to the marked segment. This is contrary to the principles of markedness.

Immediately, we are faced with a choice. Either the basic principles of sound change and markedness are wrong or the generative approach to these principles is wrong. The first choice is difficult to make, because the principles of markedness have served the Prague school (and others) so well. This leaves the second choice.

The problem with the minor rule and the universal interpretive conventions has to do with the very nature of the generative approach to markedness. This approach maintains that the bases of the feature system of one language are the same as those for all languages--that there is a universal ideal toward which all languages strive. This can be disproven simply by noting that German has developed a system in which word-final stops devoice, while Welsh (as we see in section 5.1) has developed a system in which word-final stops voice. If both languages were striving toward the same goal, and if the functional relationships within each language's phonology were secondary to universal considerations, then such a situation in which the two languages are pulling in opposite directions would never come to pass.

The problem which the consideration of word-final stop development in German and Welsh poses goes far beyond the adequacy of those particular tentative markedness conventions found in Chomsky and Halle 1968. This

problem attacks the very notion, fundamental to generative theory, that markedness conventions can be constructed on a universal basis.

The basic principles of markedness can handle this aspect of sound change without any problems. An example of a more realistic markedness convention is found in Trubetzkoy (1969:76-7). In cases of archiphonemic neutralization, as in cases of language change, if one member of an opposition is realized in the position of neutralization, then that member constitutes the unmarked member of the opposition in that particular language. If /t/ and /d/ enter into a correlation, and if /t/ is realized in the position of neutralization, then the phonologically pertinent opposition is voice, and tension is merely of phonetic pertinence. If, on the other hand /d/ is realized in the position of neutralization, then the phonologically pertinent opposition is tension, and voice is merely of phonetic pertinence. German, then, would be judged as a language with functional phonological relationships such that voice determines tension; while Welsh would be judged as one in which tension determines voice. As I demonstrate in the next chapter, such a description of Welsh is adequate.

The Prague school provides a realistic approach to markedness not found in generative phonology, at least as it stands now. In order to incorporate such a notion as that given in Trubetzkoy (1969:76-7), we would have to maintain several rewrite rules, one for each of the various language types. Such rules, however, could not be applied without reference to other points in the system, for a determination would first have to be made as to what types of functional relationships characterize the particular phonology.

Of course, we could first categorize the world's languages according

to the functional relationships in the phonologies. Then we could apply the appropriate rules to each type. This would abandon the generative theoretical notion of universality, which forms a basic tenet of the theory. Indeed, without the notion of universality, 'explanatory adequacy', which seeks to establish the innate rules of language, would be impossible to attain using the linguistic methods of the generative school (thereby, according to Chomsky 1964, making all linguistic inquiry pointless).

6.3 Directions for Phonological Inquiry. As we examine the description and argument of the first five chapters, one consideration stands out. Although the premises for proof may be faulty, the description exhibits a remarkably consistent pattern. We may not have a proof, but this pattern points to a convergence. And this convergence cannot be ignored. It is up to the Cymrist, then, to investigate this matter more thoroughly, to gather and consider evidence, and to monitor whatever developments may occur in the passage of generations.

Such an investigation cannot proceed, however, in a theoretical vacuum, for no meaningful collection and collation can be undertaken in the absence of premises, however tentative, that serve to direct the collection and collation. The construction of a more adequate theory of phonology is the task of the linguist. The linguist cannot stop with a theory of phonology, though--the theory must produce a model capable (at least) of describing Welsh in a consistent manner.

Now there are countless ways of constructing a theory, but we need not begin with no points of reference. Indeed, there have been many theories of phonology, generative among them, with strong points

and with weak points, and we can learn from both. From these points of reference, we can discern several directions for phonological inquiry.

One principle which has figured prominently in many theories is the 'inner approach' (Jakobson and Halle 1962). According to this principle, our phonology must be based upon observable data from phonetics. This is particularly important if we are to construct a phonology which can be applied to the sound system of a natural language. By beginning with the observable phonetics and abstracting the phonology, we insure that this connection between the phonology and the sound system of a natural language can be made.

Another notion that should guide us in the construction of a more adequate theory of phonology is 'naturalism'. This is to say that the elements of the phonology should be constructed in such a way as to reflect observations of language itself, rather than in a way which reflects some preconceived mathematical notions. This is not the same as the inner approach, for we could construct a phonology from the phonetics using principles unsupported by the data. For example, we could abstract features directly into a binary mode in cases which would not normally support a binary mode (compare section 6.1), in order to achieve consistence with previously stated notions of linguistic relationships. Of course, some hypothesizing about the structure of language is necessary, but this must not contradict the evidence.

The phonology, then, should be based upon data observed in phonetics. Of course, it cannot be simply the phonetic data, but must be an abstraction from them. In abstracting the phonology, each level of abstraction should represent a degree of pertinence which serves a particular

function in the system of communication. That which is abstracted from one level of abstraction to the next must be represented on the lower level of abstraction. All abstraction must be directly motivated by that which can be observed, not by that which can be conceived.

In the succeeding chapters, I attempt to determine the basic phonetic relationships in the Welsh consonant system. These are then organized into a phonological system (or, more precisely, a subsystem) consistent with our present knowledge of phonetics.

NOTES TO CHAPTER 6

¹This is the only formalism stated in King 1969 and Kiparsky 1971. Of course, the linguist uses many methods of analysis, or 'discovery procedures', in addition to the rewrite rule. Such methods, however, are not formally a part of the generative model.

²This is based upon the assumption that we cannot maintain a logical system in which practice is not consistent with theory.

³Of course, I realize that a mechanical rule can be written in this way, but the notion of rewrite rule is hardly isomorphic with the notion of process.

CHAPTER 7 ASPIRATION IN WELSH

7.0 The Basic Opposition of Welsh Consonants. Acoustic and physiological oppositions (or features) have their basis in the phonetic data. Indeed, much effort has been expended by phoneticians in the last several decades in order to provide phonetic observations for the justification of certain oppositions as well as to determine oppositions consistent with observed phonetic characteristics. For example, the phonetic basis of acoustic oppositions is examined throughout Fant 1973, and the acoustic examination of consonants has been quite extensively treated in the literature (for example, Delattre, Liberman, and Cooper 1955). Progress in this area of physiological oppositions can be found in Peterson and Shoup 1966 and Perkell 1969. I return to this in greater detail in Chapter 8.

From the standpoint of constructing a phonology from observable phonetic data, then, the notion of the opposition maintains a prominent position. Not only does the opposition command the necessary link with the phonetic data, but it also creates a convenient real unit for organization of the structure into a functional system. This is accomplished through the Prague notions of opposition theory.

According to Prague opposition theory (as found in Trubetzkoy 1969; Jakobson 1962; etc.), the various oppositions can be divided into two types (leaving the morphophonological abstractions aside). As I mention in section 6.3, these types are known as the phonology (those oppositions

with phonological pertinence) and the phonetics (those oppositions with phonetic pertinence only). In the phonology, the oppositions serve a contrastive function and predict the particular members of the phonetic oppositions. Insofar as the particular members of the phonetic oppositions are predictable from the contrastive phonological oppositions, the phonetic oppositions can at times serve (albeit indirectly) some contrastive function as well (compare Jakobson, Fant, and Halle 1952:8). Hence, as long as the phonological oppositions do serve the contrastive function, the level of pertinence of a particular opposition in a particular language may depend more upon the principle of predictability than upon that of contrast. As always, though, such a determination can only be made from considerations of the structure of that particular language.

The relationship between the oppositions of the phonology and those of the phonetics, moreover, is one of abstraction. As I point out above, the oppositions have their basis in observable acoustic and physiological phonetic data. The characteristics of these data which consistently and predictably occur are abstracted on the phonetic level. These characteristics become the oppositions of phonetic pertinence. The oppositions which consistently and predictably occur with contrastive function and which can be used in the prediction of other opposition members are abstracted on the phonological level. Those oppositions which then consistently and predictably cooccur with elements of grammatical function are abstracted on the morphophonological level.

The process of abstraction outlined above is consistent with that mentioned in section 6.3. It maintains the inner approach to phonology, defines its relationships in a manner at least not incon-

sistent with the phonetic data, and abstracts such that whatever is abstracted on a higher level (that is, a more abstract level) is present on the lower (less abstract) level of abstraction. Thus, a minimum of assumptions is introduced to the phonology.

We have been concerned throughout this work with the consonant system of Welsh, and particularly with the relationships that obtain between the stop cognates. As Trubetzkoy (1969:76-7) points out, there are two oppositions that have a special relationship in stop cognates in many languages. These are the oppositions of voice and tension. In the stops of these languages, one of these two oppositions is of phonological pertinence and the other of phonetic pertinence only. In positions of neutralization, where one of the members of the phonological opposition is realized, the weaker, unmarked member occurs.

For example, in German we find a position of neutralization for obstruents in word-final position. Thus, the /t/ in Land /lant/ 'land (nominative)' alternates with the /d/ in Lande /lande/ 'land (dative)', such that the final stop is voiceless and (in Standard German) fortis. In Welsh, on the other hand, we find a position of neutralization for stops in word-final position which is realized in precisely the opposite manner from the German. The /g/ in teg /teg/ 'fair' alternates with the /k/ in teced /teked/ 'fair (equative)', such that the final stop is voiced and lenis. Whereas the voiceless member of the opposition of voice is the unmarked and the lenis member of the opposition of tension is the unmarked, we can conclude that voice is the phonologically pertinent opposition in German and tension is the phonologically pertinent opposition in Welsh (compare the 'principium divisionis' of Jakobson 1962:23).

As mentioned in section 6.2, sound change, as well as neutralization, occurs with respect to the unmarked member of the phonologically pertinent opposition. Once we recognize that Welsh is a 'tension language', it is not difficult to accept a change in the system in which the voiced stop replaces the voiceless, for voice in such a system is of phonetic pertinence only.

The notion that the basic opposition in Welsh stops should be tension, with fortis and lenis members, ought not to cause much surprise among Cymrists. In fact, this is the traditional interpretation of the consonant system. A change from the voiceless aspirated stop to the voiced unaspirated stop is known historically and in the mutation system as lenition (compare the term treigladd meddal 'soft mutation'), while a change in the opposite direction is known as provection (calediad 'hardening').

In spite of its convenience and its traditional background, the opposition of tension and the notions of fortis and lenis are difficult to define phonetically, especially that type of tension often described as being pertinent to consonants. Tension is a cover-term for an opposition which is realized in different ways in different languages. Just how it is realized in Welsh demands an examination of the language.

At this point, I should like to return to the manner of neutralization in German as opposed to that in Welsh. In German, the marked phonological opposition member of the opposition of voice is realized as the voiceless unmarked member; while the phonetic opposition member of the opposition of tension, which would be unmarked if German were a tension language, is realized as the fortis member, which would be marked if it were a tension language. On the other hand, in Welsh,

the marked fortis phonological opposition member is realized as the unmarked lenis member; while the phonetic voiceless opposition member, which would be unmarked if Welsh were a voicing language, is realized as the voiced member, which would be marked if it were a voicing language. Thus, the oppositions of voice and tension in Welsh, as well as in German, are complementary.

As Welsh has only two phonologically pertinent classes of stops, we can consider (for the moment) the opposition to be privative, capable of being described with binary features (presence versus absence of singular features). If we turn, then, to the specifications of features in Table 1.0.c, we find that one feature is indeed complementary to voice. This feature is aspiration. Because the opposition described as tension is complementary to voice and aspiration is complementary to voice, we might consider that tension is realized in Welsh through the opposition of aspiration. Of course, a conclusion that tension includes or consists of aspiration cannot be made on the basis of these facts alone. Nevertheless, in this chapter I demonstrate that aspiration is indeed the opposition through which this cover-term of tension is realized in Welsh, and that aspiration is the basic opposition not only of the stops, but also of the entire class of consonants.

In order to determine the place of aspiration in the Welsh consonant system (or subsystem), it is necessary to determine first just what aspiration is. This entails an investigation of the nature of aspiration in the phonetic system of Welsh and the relations which hold between aspiration and the other oppositions in the phonology proper.

7.1 The Prosodic Nature of Aspiration. It is mentioned in the previous section that tension is a difficult opposition to define, as various languages realize tension in various ways. The opposition of aspiration is also difficult to define even within one particular language. It involves apparently a release of pressure somewhere in the vocal apparatus, but just where this pressure is exerted and how it is released is open to debate. In Chapter 10, I treat this problem in some detail from an acoustic and a physiological standpoint.

Wherever this aspiration emanates from, it is realized in a manner similar to the glottal fricative /h/. It can be realized alone in syllable-initial position, in which case it is known as preaspiration (before the nuclear vowel). On the other hand, it may be realized in conjunction with some other consonant, in which case it is considered to be the aspiration of that consonant.

When we speak of a particular opposition member as being realized in a particular consonant (for example, an aspirated stop as a stop with aspiration), we mean that that opposition member is inherent in the consonant. An inherent opposition is just one of two basic types of opposition. The other type is the prosodic opposition. Whereas the inherent opposition is thought to belong to a particular segment (or phoneme), the prosodic opposition occurs over segmental boundaries. To be sure, the range of a prosodic opposition depends to a great extent upon the segments with which it interrelates in the syllable, but, unlike the inherent opposition, it is not bound to the range of the segment. The nature of a prosodic opposition is most easily seen in stress, pitch, and tone (in fact, these are the only prosodies given by Trubetzkoy 1969)--the suprasegmentals or secondary phonemes of

Bloomfield (1933:90).

The nature of the opposition of aspiration, whether it is inherent or prosodic, can most clearly be seen in some phenomena involving voicing and aspiration in word-initial consonant clusters. As can be seen in the data of Fynes-Clinton 1913, when a liquid follows a word-initial voiced unaspirated stop, it is voiced. Immediately, the notion of noncontrastive distribution comes to mind. But it is nonetheless conceivable that it is merely coincidence that voiceless liquids follow voiceless aspirated stops while voiced liquids follow voiced unaspirated ones.

The mutation system, as presented in Chapter 1, shows that this relationship is far more than just coincidence. As we see in soft mutation rule 1.1.a, in environment II a voiceless aspirated stop is realized as a voiced unaspirated stop. The voiceless liquid following the radical, moreover, is realized in soft mutation as the voiced cognate. For example, we find the following forms in Fynes-Clinton 1913 (entered in alphabetical order):¹

<u>radical</u>	<u>soft mutation</u>	<u>gloss</u>
plaid ◌ _o	blaid	party (political)
plum ◌ _o	blum	lead
pren ◌ _o	bren	tree
pr:od ◌ _o	bri:od	married
tlaud ◌ _o	dlottad (equative)	poor
traí ◌ _o	draí	ebb-tide
trevn ◌ _o	drevn	order
kledi ◌ _o	glédi	hardship
klox ◌ _o	glox	bell

<u>radical</u>	<u>soft mutation</u>	<u>gloss</u>
<u>kra</u> :s	<u>gra</u> :s	dry
kri:st	gri:st	Christ

An initial stop can also be followed by a nasal /n/. When this nasal follows the voiceless stop, however, it is voiced, as in the following data (also Fynes-Clinton 1913):

<u>radical</u>	<u>gloss</u>
pnaun	afternoon
pnelin	elbow
knaud	flesh
kniu	knee

When the spirant mutation rule 1.3 applies to a voiceless aspirated stop preceding a voiceless liquid, the radical is realized as a voiceless fricative, but the liquid is realized as the voiced cognate. Thus, we find the following (Fynes-Clinton 1913):

<u>radical</u>	<u>spirant mutation</u>	<u>gloss</u>
pl̥i:	fl̥i:	feathers
pr̥i:s	fr̥i:s	price
tr̥aus	θraus	trans
klebar	xlebar	chatter
kr̥o:di	xr̥o:di	crowdy (fiddle)

At this point, we can make a generalization. The presence of voice in the liquid is determined by the presence of voice (and aspiration) in the stop, but it is not dependent upon the absence of voice in the initial fricative.

In the nasal mutation rule 1.2.a, we find a more complex situation. The voiceless aspirated stop is realized as a voiceless nasal with the aspiration heightened to the degree of a glottal fricative /h/, as though this glottal fricative were a separate segment as in preaspiration. When the consonant realized as the nasal mutation form of a voiceless aspirated stop is followed by a liquid or by a nasal, the liquid or nasal is not only voiceless, but it is followed by the aspiration of the initial segment--the glottal fricative. Thus, we find the following (Fynes-Clinton 1913):

<u>radical</u>	<u>nasal mutation</u>	<u>gloss</u>
p _o le:θ	m _o he:θ	plaiting
pnelin	m _o nhelin	elbow
t _o ræmdar	n _o rhæmdar	dead of night
kli:st	n _o lhi:st	ear
krombil	n _o rhombil	gizzard
knottin	n _o nhottin	diminutive epithet

If we are only concerned here with inherent oppositions, then we should be able to handle these and like phenomena through a segmental description, such as that found in generative or structural phonology (phonemics). Let us first, then, treat the data from the assumption that whatever alternations occur do so through the implications of inherent oppositions only.

Considering first the soft mutation data, it would appear as though we have nothing more than a case of voice assimilation. The voice of a liquid is determined by the voice of the preceding stop. In generative terms, this could be handled by a rule, making use of the 'alpha-switching'

notational device (see Griffen 1975). Such a notion is insufficient, for we also find such items as the following (Fynes-Clinton 1913):

<u>item</u>	<u>gloss</u>
sdra:in	strain
sdremp	smudge
sdri:d	street

In these items, we find a voiceless (unaspirated) stop preceding a voiced liquid. In fact, there are two voiceless consonants before the voiced liquid.

From the above items, it would appear that aspiration is involved. The /s/-plus-stop environment is a well-known deaspirating environment in English (see Gleason 1961:263; Kurath 1964:74) as well as in Welsh (see Fynes-Clinton 1913:xxii). From these data we might consider that the aspiration of the initial consonant determines the voice of the following sonorant. Such a notion as the opposition of one segment determining a different opposition of another, however, is actually prosodic, for it requires an opposition to dominate a range irrespective of segmental boundaries. Thus, in a segmental solution relying only upon inherent oppositions, we cannot determine the voice of one segment by the aspiration of another--we must search out another solution.

We could modify our voice assimilation by further restricting the environment of its application. We could specify that it only applies where the stop preceding the liquid is in word-initial or syllable-initial position. In order to avoid other deaspirating environments, we might find it necessary to further restrict the environment of application through stress.

When we consider the phenomena surrounding nasal mutation, however, the segmental, inherent-opposition solution falters. There are two problems in accounting for the alternation of, for example, [pnelin] and [mnhelin] through inherent oppositions only. Nasal mutation will produce an initial cluster /mhn-/. The problems are (1) how to have the aspiration realized on the other side of the /n/ and (2) how to account for the devoicing of the /n/.

In solving the first problem through inherent oppositions, we would have to rely on metathesis. Once an opposition is removed by two segmental boundaries from the segment to which it belongs, though, we are not really operating with inherent oppositions. Furthermore, if we cannot use prosodic oppositions, accounting for the voiceless /n/ becomes a formidable task. As we see in the stop-plus-nasal clusters, above, the voicelessness of the initial consonant is not sufficient to cause the nasal to be realized as voiceless. Yet, in this case it must be sufficient. These two problems, especially when taken together, are so complex as to render the solution with inherent oppositions inoperable.

On the other hand, by making use of aspiration as a cluster prosody (compare Robins 1957), we can account for these phenomena quite simply. Given the notion that, by definition, that which is aspirated is voiceless (at least, in Welsh), we can account for the data by adopting the notation of prosodic analysis (see Firth 1948), as follows:

$$\frac{h}{PL} \qquad \frac{h}{PN} \qquad \frac{h}{NS}$$

This is to say that aspiration from an aspirated (voiceless) stop dominates the following liquid but not a following nasal; while that of an aspirated nasal dominates the following sonorant and the onset of

the vowel. Where an /s/ precedes the cluster, the aspiration would emanate not from the stop, but from the /s/,² allowing us to maintain a voiceless but unaspirated stop and a voiced liquid.

In our Prague-oriented method of abstraction into a level of phonological pertinence, outlined in the previous section, this development is particularly important. The opposition of voice can always be predicted from the opposition of aspiration, but not vice versa. This shows that of the two, aspiration and voice, though both could serve a contrastive function (at least indirectly), aspiration satisfies the predictability requirement. I return to this notion in the next section.

In an unpublished manuscript, Lockwood (ms.) incorporates the Firthian notion of prosodic analysis into the stratificational model by means of the 'quasi-step matrix' (compare the matrix of Lamb 1966b). This device reflects the prosodic nature of the dominating opposition (or component) in the hypophonemic stratum by allowing components to overlap several columns in the matrix, thus reflecting the phonetic fact that speech is continuous rather than the utterance of one group of components after another.

In Figure 7.1, we see that this innovation in the matrix of /~~mh~~helin/ not only incorporates the Firthian notion of prosodic domination, but it also incorporates the Prague notion of contextual neutralization and assimilation of oppositions (see Trubetzkoy 1969). In Griffen 1975, I demonstrate how generative phonology can also describe the same phenomena through using aspiration as a prosodic opposition. No matter what framework is used, however, only by recognizing the prosodic nature of aspiration in Welsh can the data be adequately represented.

m	n	h	e	l	i	n
o	o					
Ns	Gl	Vo	Lt	Vo	Ns	
As		Vc				
Lb	Ap		Ml		Hl	Ap
			Fr		Fr	

Figure 7.1
Quasi-Step Matrix of /mnhelin/

The implications of the basic opposition of a language being prosodic rather than inherent are quite far-reaching. As we see in the next section, we can expect relations between various segments in the phonological system to apply without respect to the boundaries of these segments. For example, as aspiration associated with a particular stop is normally explosive (that is, being realized after closure), an aspirated segment following a stop is liable to have considerable effect on that stop.

More than this, however, the notion that the basic opposition of Welsh should be prosodic and should operate without regard for segmental boundaries calls to question the very notion of segments themselves, as meaningful units of phonological structure. Certainly, the fact that the segmental boundaries can be disregarded by the basic opposition raises the question as to whether all boundaries can be disregarded by any opposition. In other words, if the basis of the consonant system is nonsegmental, what of the consonant system itself? I return to this question in section 7.3 and in Chapter 8.

7.2 Aspiration in the Phonological System. In the previous section, we find that aspiration determines voice in sonorants in certain consonant clusters. The aspiration of any aspirate consonant is sufficient to devoice a following liquid in a cluster, and heightened aspiration is sufficient to devoice a following nasal (or, more precisely, to account for the realization of the voiceless cognate in such clusters). Such evidence is necessary to show that tension, which determines voice, is realized through aspiration, but it is not sufficient to show that the opposition of aspiration is the basis of the consonant subsystem of this tension language. After all, similar phenomena can be found in German, a voicing language (compare section 6.2).

In order to demonstrate that (at least for all practical purposes) the opposition of aspiration is the medium through which the tension relationships in the phonology are realized, and that, as such, it forms the basis of the phonological relationships in the consonant subsystem, it is necessary to examine the structure of the consonant subsystem within the phonology and the manner in which this structure interacts with the opposition of aspiration. As I point out in section 6.1, the structure of those consonants which enter into any relationships with other consonants (in the Standard Welsh, this includes all consonants except /s/³) is organized along the lines of the fortis-lenis scale, as found in Table 6.1. As Welsh is a tension language (as shown through its markedness relationships in section 6.2), an organization of the structure on the fortis-lenis scale is expected.

A more complete structure of the consonant subsystem can be found in Table 7.2.a. This structure takes into account the nasals, which are related with the structure in such a way that columns 2 and 3 may

be considered as parallel to the stops in columns 2 and 3. For ease of conceptualization, we might consider the nasals of columns 2 and 3 positioned above the stops in a three-dimensional structure, such that a stop in column 2 will relate not only with the consonants in columns 1 and 3, but also with the nasal in column 2. To the basic relationships of the opposition of tension, this adds those of the opposition of nasality (compare the superimposed bundles of Trubetzkoy 1969:88).

Table 7.2.a
The Consonant Subsystem of Welsh⁴

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>2</u>	<u>3</u>
v	b	p	f	m	mh o
ð	d	t	θ	n	nh o
-	g	k	x	ŋ	nh o
l	ɫ				
r	ɾ				

As I mention in section 6.1, such a scale bears a strong resemblance to the strength scales of Foley 1970a. In fact, it is identical to his beta-strength scale in its fortis-lenis relationships. Although the strength scales of Foley 1970a are totally useless from the standpoint of determining the basis of relationships, they are nonetheless quite useful in that they do summarize important synchronic alternations and diachronic changes on the phonological (or at least graphemic) level.

The synchronic phonological relationships between the columns are the following: Column 2 and column 1 are related through soft mutation (section 1.1); column 3 and column 2 are related through soft mutation; column 3 and column 4 are related through spirant mutation (section 1.3);

the two columns 2 and the two columns 3 are related through nasal mutation (section 1.2). In this section, I demonstrate that the horizontal relationships in Table 7.2.a can be explained through the opposition of aspiration.

Relationships between elements in the gradual opposition of tension (the fortis-lenis scale) are categorized into two types. As is the case with the mutations, these relationships are traditionally couched in terms of processes--the process of lenition and the process of provection. Traditionally, lenition consists of a change from a stronger to a weaker opposition member (from one number in Table 7.2.a to a lower number), while provection involves a change from a weaker opposition member to a stronger one (from a lower number to a higher).

The first element of lenition to be considered is the notion of soft mutation. In traditional terms, the mutation of a voiceless aspirated stop radical to its corresponding soft mutation form involves a mutation to a more lenis consonant. Now there are two oppositions involved--voice and aspiration. As a change from voiceless to voiced in Welsh would be, if anything, a strengthening along the fortis-lenis scale, from the observable oppositions in the change, it would appear as though deaspiration is involved. In this case, deaspiration is at least isomorphic with lenition.

An interesting development in the history of soft mutation is the creation of the consonants ll /l/ and rh /r/ (in a manner similar to the development of the affricate subsystem--see Griffen 1974b). Due to their behavior in borrowings as lenis initials (see Griffen In press a), l /l/ and r /r/ can be seen to be members of column 1. According to Jackson (1953:473-80), where Brythonic maintained a non-lenited liquid

(a liquid not in the environment of lenition--at that time the environment was phonological), by around the tenth century, Welsh developed the lateral and trill fricatives. In Modern Welsh, this process continues in the corresponding grammatical environment, such that a word borrowed with a column-1 initial consonant will eventually change such that the initial consonant is realized as its column-2 cognate except, of course, in soft mutation.

The relationship between the liquids and their corresponding fricatives can easily be accounted for through aspiration. As in the relationships between the column-3 and column-2 stops, voicing is not primary, as this process would run counter to lenition. The question then becomes, 'What is the difference between /l/ and /l/, and /r/ and /r/?' Taking the change in voice into consideration, a strong case for analogy could be made between the lenition of voiceless aspirated stops and that of voiceless lateral and trill fricatives, establishing the pertinent difference to be one of aspiration. As aspiration is some sort of release of pressure and this release would be realized through a glottal-fricative-like sound, a relationship between a liquid and a fricative variant can readily be seen through pressure added to the continuance of the liquid. The orthography gives us another indication as to the basis of the relationship being aspiration, as the forms have often been written (up to the standardization of the alphabet in the early twentieth century) as lh and rh. Indeed, the trill fricative is still written today with the h. It is not, however, through lenition that the relationship becomes most clear, but through provection, as I demonstrate below.

The relationship between the column-3 consonants and the column-2

consonants is based upon aspiration, as is the relationship between the lateral and trill in column 2 and those in column 1. This gives us a basis for two analogies to establish aspiration as the basis of the relationship between the remaining consonants in columns 1 and 2. Unfortunately, the strength of such an argument relies wholly upon the strength of analogy as a method of extension. Such evidence, then, is hardly conclusive; although, to be sure, it is evidence.

Another analogy can be made from the relationship between the consonants in columns 2 and 3 in the position of neutralization. In Middle Welsh, the letters p, t, and c (or k) were used in word-final position to represent the voiced unaspirated stops in the position of neutralization (see section 5.1). In the same position, the letter d represented the voiced dental fricative /ð/ (see Evans 1960:5; Watkins 1961:78).

Now at this point, we ought to consider what causes a stop to be realized as the voiced cognate in word-final position. According to Pilch 1958, even where a voiceless stop does occur in word-final position, it is not aspirated. For example, Pilch (1958:40) transcribes twp 'stupid' as /²thup/, showing that aspiration may occur in initial position, but not in final position.⁵ The reason why word-final position should be a position of neutralization of the opposition of aspiration would appear to be the relative difficulty of pronouncing an aspirated sound at the end of a word in continuous speech (compare Trubetzkoy 1969:262, in which the correlation member most frequently found in continuous speech should be the unmarked).

This neutralization of aspiration in word-final position indicates two things. First, the realization of an archiphoneme on the basis of

the markedness conditions in the opposition of aspiration should indicate that it is the opposition of aspiration (or an opposition isomorphic with it) which serves as the phonologically pertinent opposition between the two classes. Second, if the position of neutralization is dependent upon the opposition of aspiration in this case, it may also be dependent upon the same opposition in the same environment in the case of the realization of d as /ð/. Again, because of the nature of analogy, the latter evidence is necessarily weaker than the former.

The relationship between aspiration and the various degrees of the fortis-lenis scale is best demonstrated through the process (traditionally speaking) of provection. There are many different types of provection in Welsh. The one type, though, which shows the closest connection with aspiration is one which I call 'aspirate provection'.

In Modern Welsh, aspirate provection often surfaces in a type of poetry known as cynghanedd. The complex rules of cynghanedd require patterns of alliteration between the first half of a line of verse and the second. For example, A.Ll. Roberts 1973:15 cites the following line of verse:⁶

Ochain cloch : a chanu clir

In the aspirate provection, when a voiced unaspirated stop precedes an /h/, the stop becomes the voiceless aspirated cognate. A.Ll. Roberts 1973:47 cites the following lines:

Y poen : yn ei hwyneb hi

Onid hen : yw cerddi'n tud?

A thrig hedd : uwch llethrau cwm

The /h/ represents aspiration in its simplest form. When this aspiration precedes a stop, there is a shift in syllable boundary so that the glottal fricative becomes the explosive element of the stop. Voice, being the phonetically pertinent opposition, is determined by the aspiration.

More important than the provection caused by the following /h/ is that caused by a following rh /ɣ/. A.Ll. Roberts (1973:47-8) also cites the following correspondences in the cynghanedd:

Y mab rhad : mwyach a'm pryn

Onid rhyw awr : yw'n byw trist?

Mae eisiau cred : ymysg rhai

The relationships illustrated in these correspondences not only establish aspiration as the opposition linking the consonants of column 2 with those of column 3, but they also demonstrate the aspirate nature of the fricative cognates of the liquids. Once the aspiration is removed from the fricative in order to 'harden' the voiced unaspirated stop, the remaining oppositions of /ɣ/ are identical to those of /r/. Thus, the relationship that obtains between at least half of the consonants of column 1 and their cognates in column 2 can be seen to be nothing else but aspiration. This adds considerable weight to the

analogy that would link the remaining two consonants of column 1 to their column-2 cognates through aspiration, as well as, indirectly, it supports the other two analogies.

A particularly interesting application of aspirate provection is found in the creation of family names. In the Middle Ages, Welshmen did not generally use family names. A man would use the familiar 'son of' formula, as in the name of the famous knight Owen ap Urien (Owen son of Urien). This ap 'son of' is pronounced /ab/, due to the nature of the word-final position of neutralization. At the end of the Middle Ages, when (in accordance with decrees of the English occupation) family names were taken, many Welshmen simply took the final consonant of ap /ab/ and added it to the initial vowel of their fathers' names. Thus, a man who had been known as, for example, Idris ap Owen (Idris son of Owen) might have taken the name Idris Bowen. Where a father's name began with an /h/, however, we find aspirate provection, such that, for example, Idris ap Hugh might have taken the name Idris Pugh, and Idris ap Howell might have taken the name Idris Powell. Moreover, where the father's name began with /x/, we find the same aspirate provection as that in the poetry, such that, for example, Idris ap Rhichard (or Rhisiard) might have taken the name Idris Prichard (or Prisiard), and Idris ap Rhys might have taken the name Idris Prys (or Price).

This aspirate provection is not limited to poetry and family names. It is quite productive in the spoken language, and Fynes-Clinton (1913:xviii) notes that it is found in the Bangor district dialect. For example, we find the following pronunciations:

<u>orthography</u>	<u>transcription</u>	<u>gloss</u>
ei mab hi	i mha: p _o i	her son
ei thad hi	i θa: ti	her father
ei cheg hi	i xe: ki	her mouth

We should take special note of what might appear to be a 'shift' in syllable boundaries, for it shows a realization of a voiced unaspirated stop along with a unit of aspiration. The only way that such a phenomenon could occur is through the prosodic nature of the opposition of aspiration, a nature which allows a segment (/h/) to effectively merge with another segment without regard to the supposed segmental boundaries.

This nature of aspiration as a prosody, demonstrated in the previous section, becomes extremely important with another type of provection. Not only does an occurrence of aspiration following a voiced unaspirated stop result in the realization of a single voiceless aspirated stop, but an occurrence of two identical voiced unaspirated stops in one position in the syllable (onset or coda) also results in the realization of a single voiceless aspirated stop. This type of provection I call 'geminate provection'.

The geminate provection has been productive since the transition period between Brythonic and Old Welsh, where it culminated in the loss of syllables. For example, Morris Jones (1913:182) cites the Brythonic name Cato-tigirn- /katotigirn/ as developing into *Cad-diyirn- */kaddiyirn/, then Cattéyrn /kat(t)eirn/, and finally Catéyrn /kateirn/. In the Modern Welsh dialect of the Bangor district, Fynes-Clinton (1913:xxiii) cites the following:

<u>orthography</u>	<u>transcription</u>	<u>gloss</u>
pob blwyddyn	po:p plu:ɪðɪn	every year
gwybod dim	gubot tɪm	not to know
tebyg gennyf	tebɪk kɪn ɪ	I suppose

Whether there is a shift in syllable boundary here is not given by Fynes-Clinton. In the case mentioned above, the shift in boundary is mentioned in passing, only after all forms are given. Although no mention is made here, a shift is probable, taking into consideration the nature of provection.

Geminate provection can also arise when a prefix ending in a voiced unaspirated stop precedes a root beginning with an identical stop. For example, the prefix lled- /led/ 'half' may be affixed to the noun tyb /tɪb/ 'opinion'. After the application of soft mutation (see Evans and Thomas 1968:452), the result is lletyb 'letɪb/ 'doubt', which may alternatively be realized in the verb-noun form as lled-dybio /ledɔbyo/ (compare Bwrdd Gwybodau Celtaidd 1942:95).

In order to understand this type of provection, it is necessary to consider the nature of aspiration as a prosody. Working within a framework which recognizes the segment, it is not easy to visualize the relationships involved, and I return to this notion in Chapter 9. Nonetheless, we can see that the development of this phenomenon involves placing two identical stops into one slot in the syllable. If the stops were not homorganic, we could get a cluster; but so long as they are homorganic, they cannot be pronounced as geminates in a single position in a syllable (see section 8.2)--the nature of stops as elements of closure does not allow this.

Although a stop involves a single act of closure, it may also be

accompanied by a prosody. Now if the prosody constitutes a gradual opposition, then the prosody is realized in each member of the opposition in a scale of gradual presence. From Table 7.2.a, we can see that the phonological relationships in the consonant subsystem are organized along the lines of a gradual opposition. For the realization of two stops from column 2 as one stop from column 3, we would need some opposition present in both of the column-2 stops to combine so as to create the level of strength found in column 3. Of course, in order for such an opposition to combine without regard to boundaries, the opposition would have to be prosodic.

Thus, there is some sort of prosodic opposition which parallels the system shown in Table 7.2.a, at least as far as columns 2 and 3 are involved. It is difficult, however, to say that this opposition is aspiration, as we would assume that some degree of aspiration is present in the column-2 stops, and aspiration (as it is usually conceived in the sound of [h]) is not readily perceived in these voiced unaspirated stops. This does not mean, however, that aspiration could not be realized in different perceptual ways in different degrees of the opposition. I examine this phonetic problem in Chapter 10.

The relationship between this type of provection and the aspirate provection, which is definitely a case of the opposition of aspiration, is brought out in the poetry of the cynghanedd. The geminate provection of two voiced unaspirated stops is not normally used in alliteration with the voiceless aspirated stop but with the realization of the aspirate provection. A.Ll. Roberts (1973:48) cites the following lines of verse:

Byd heb heddd : nid byd heb boen



Onid hardd : dy henwlad di?



Deg rhodd : y godidog Grist



This practice of the cynghanedd shows that the relationships that obtain between the voiced unaspirated stops of geminate provection and the voiced unaspirated stop and aspiration of aspirate provection are either the same or isomorphic. The prosody involved in geminate provection, then, is either the opposition of aspiration (which is the only prosody that has been (or can be) demonstrated from the data associated with the fortis-lenis scale) or some opposition isomorphic with it. By 'isomorphic' I mean 'sharing all pertinent characteristics', including the nature of aspiration in the system of relationships that hold in aspirate provection (the [h]-sound possibly being phonetic, not phonological).

It is important to appreciate the (at least) isomorphism of the relationships that obtain in one case in the voiceless aspirated stop, in another case in the combination of a voiced unaspirated stop and aspiration, and in yet another case in the combination of prosodies through the realization of two identical voiced unaspirated stops as a single voiceless aspirated stop. Comparing the last-mentioned relationship with the first two, we find the aspect of the gradual opposition that is most pertinent to the aspiration hypothesis. This aspect consists of two points: (1) The gradual prosodic opposition that forms the basis of the consonant subsystem behaves in such a manner that the combination of two units of prosody (that is, two levels of strength) in a realization of a consonant in column 2 results in the realization

of the cognate consonant from column 3; and (2) the nature of this prosodic opposition is identical to the nature of aspiration.

These two aspects of the gradual opposition forming the basis of the scale of relationships found in Table 7.2, gain particular meaning when viewed in conjunction with the development of the voiceless fricatives, the elements of column 4. According to Jackson (1953:565-73), the voiceless fricative developed during the Brythonic period through the same process that we find in the geminate provection. When two identical voiceless stops from column 3 combined, the result was a single realization of the cognate from column 4.

Again, if two identical stops come together in one slot in the syllable, the nature of the closures associated with the stops cannot be realized in a cluster. The prosodies, however, can combine. In the voiceless aspirated stop, moreover, the prosody can be perceived as the [h]-sound of aspiration. Thus, the member of the prosodic opposition that combines in geminate provection from column 2 is realized in the combination as the aspiration; while this aspirate member of the gradual prosodic opposition that combines in geminate provection from column 3 is realized through voiceless frication, which may be perceived as an exaggeration of the [h]-sound.

This notion is supported in the development of the orthography. At least in the case of /θ/ and /x/, the spelling of these consonants was rendered (sporadically, to be sure) by the letter for the voiceless aspirated stop followed by h as early as the late sixth or early seventh century. For example, we find the Brythonic inscription MACCODECHETI from that period (Jackson 1953:566). Indeed, even after the spelling reforms of the early twentieth century, the spirant mutations derived

from the voiceless aspirated stop radicals are still rendered in this manner, even in the case of ph /f/, representing a sound written as ff /f/ elsewhere.

Examples of geminate protraction of voiceless aspirated stops can be found in words derived from Latin and Brythonic. Welsh cyff /kɪf/ 'stem' is derived from Latin cippus /kippus/, Welsh Brython /brəθon/ 'Briton' is derived from Brythonic Brittonēs /brittones/, and Welsh pechod /pexod/ 'sin' is derived from Latin peccātum /pekka:tum/ (Morris Jones 1913:175).

Further evidence of the presence of aspiration in the consonant subsystem can be found in the aspirate mutation. As we see in section 1.4, this mutation involves the addition of preaspiration to an initial vowel. In Standard Welsh, this mutation only affects vowels, but in some dialects, including the dialect of the Bangor district, the glides and the labial nasal are also affected. In Fynes-Clinton (1913:xviii), for example, we find the following:⁷

<u>orthography</u>	<u>transcription</u>	<u>gloss</u>
ei (h)iaith	i hyaiθ	her language
ei (h)wats	i hwač	her watch
ei mab hi	i mha: pi _o	her son

In the last item of the above examples, a consonant of the nasal column 3 is found as a result of the addition of aspiration in aspirate mutation to its cognate from nasal column 2. The relationships that hold between the nasal columns of Table 7.2.a can thus be seen to consist wholly of aspiration.

There is one final piece of evidence to be gleaned from the aspirate

mutation. We should take note that one of the most common environments of aspirate mutation, that mentioned in the preceding examples, is identical to one of the most common environments of spirant mutation, environment IVb (compare also section 2.8). This, combined with the nature of the development of the voiceless fricative in Brythonic, may give added credence to the notion that aspiration still forms the basis of the relationship between the consonants of column 3 and those of column 4 in Modern Welsh.

One final case of provection can be found in the behavior of lenis initials in Welsh borrowings (see Griffen In press a). As I mention above, when a word is borrowed into Welsh with an initial consonant from column 1 of the Table 7.2.a, this lenis initial 'hardens' to the cognate from column 2. The reason for this is that word initial position is a position of relative strength, insofar as the relationships between the consonants of the gradual opposition are concerned. Due to this position, the provection occurs. For example, English velvet has been borrowed as melfed, Latin liber /liber/ 'book' has been borrowed as llyfr /lɪvr/, and English rack has been borrowed as rhac /rak/ (or [ɾag]), etc. As in the case of lenition from the column-2 consonant to the column-1 consonant, the influence of aspiration in cases other than the liquids can only be ascertained through analogy.

Through the processes of lenition, we can account for the relationships that hold between the consonants of column 2 and those of column 1, as well as for those relationships that hold between the consonants of column 3 and those of column 2. Through the processes of provection, we can further account for the relationships that hold between the consonants of column 1 and those of column 2, between the consonants

of column 2 and those of column 3 (as well as between the nasal columns), and between the consonants of column 3 and those of column 4.

Furthermore, for all relationships between the various members of the gradual opposition except two of the four consonants of the lenis-most opposition member, there is direct evidence to support the notion that the prosody underlying the relationships is aspiration. In those two exceptions, there are several analogies to give indirect evidence to support the same notion.

Thus, it would appear that the gradual opposition through which the consonant subsystem of Welsh phonology is structured is either the prosodic gradual opposition of aspiration or some opposition isomorphic with it. By making use of the notion of phonological pertinence versus phonetic pertinence, the basic foundation of our abstraction system, we can effectively merge these two choices into one. This can be done by maintaining that the [h]-sound of aspiration is a phonetic characteristic of the phonological opposition of aspiration realized in certain conditions. Such a stance is consistent with the inner approach, for in reality, all sounds are phonetic in nature. Just as the vibrations of the vocal cords in the realization of certain members of the opposition are phonetic but not phonologically pertinent, there is no reason why the [h]-sound could not be a phonetic symptom of aspiration but not the phonologically pertinent basis. In Chapter 10, I investigate the question of just what the common phonetic elements of this gradual opposition are.

Taking this phonological opposition of aspiration to be the basis of the consonant subsystem of Welsh, I reconstruct Table 7.2.a into Table 7.2.b. This new table brings out several points important to this

analysis. First of all, it is structured along an order-and-series framework (compare Martinet 1952), in which the various orders can be seen to be functionally contrastive positions of articulation. Phonologically, the members of the opposition in each order vary only in the degree of phonological aspirate prosody associated with them. Because word-initial position has played such an important role throughout the past six chapters, column 2 of Table 7.2.a is taken to be the zero (or basic) position in the scale, as this is the position to which the stronger members change in the alternations and developments of Chapters 3, 4, and 5 (whether or not these constitute enough evidence for a shift) and as this is the position to which the weaker members change in borrowings. No mathematical relationships are implied in the numbers used.

Table 7.2.b
The Consonant Subsystem of Welsh

-1	0	+1	+2	0	+1
b ^u	b	bh	bhh	bn	bhn
d ^u	d	dh	dhh	dn	dhn
g ^u	g	gh	ghh	gn	ghn
l ^u	l				
r ^u	r				

In the notation of Table 7.2.b, each degree of aspirate prosody within the gradual opposition is represented by the symbol /h/, while the degree weaker than the basic level is represented by /^u/. Nasality is represented by the symbol /n/. There are certain conventions connected with this system. For example, the symbol /g^u/ is a place-filler

for zero, and the subtraction of one degree of aspiration from /bn/ causes the /n/ not to be realized.⁸

This system of orders and prosodies (taking nasality to be prosodic-- compare E.W. Roberts 1972) accounts for all relationships (including mutations) in the Welsh consonant subsystem with a maximum of uniformity. All lenition is simply the reduction of one degree of aspirate prosody within a single order, provection is the addition of one degree, and nasalization is the addition of one degree of nasal prosody within a single order. All alternations and changes discussed in Chapters 1 through 5 can thus be accounted for through the shift in one, and only one, prosody. One point must be stressed: Although I use symbols purely as a mnemonic labeling device to show a zero-degree and a minus-degree, the nature of aspiration as a phonological gradual opposition means that in reality the opposition is ever present in various degrees of realization.

From the standpoint of the predictability principle, one point has become evident throughout this section. The gradual opposition of phonologically pertinent aspiration can always predict the phonetic occurrence (or optionality) of voice, but voice cannot predict aspiration. Moreover, in the neutralization of aspiration cited in Pilch 1958, the fact that it is aspiration which is lost (or, more precisely is not realized) further indicates that voice is a predictable phonetic opposition. (Compare Watkins 1961:24.)

7.3 The Implications of a Prosodic Base. In the previous section, we see that the consonant relationships of Welsh can be handled through a structure organized in accordance with the opposition of aspiration.

If this opposition of aspiration were an inherent opposition, there would be no particularly important implications in our using it. However, as we see in the cluster phenomena in section 7.1 and in the realization of provection, aspiration is not an inherent opposition, but a prosodic one.

The nature of the opposition of aspiration as a prosody makes this opposition particularly interesting in a phonological structure. The prosody operates without regard to boundaries of segments. Thus, we find the opposition, through the phonetic [h]-sound that characterizes it in particular opposition members, extending into segments. For example, the liquids of section 7.1 become devoiced by this aspiration following the voiceless aspirated stop that precedes them, and the nasals following aspirated nasals become devoiced and followed by the aspiration of the initial nasals. Likewise in aspirate provection, the following [h]-sound spreads its domination into the preceding stop, devoicing it.

Furthermore, in the geminate provection, we find additional evidence of the disregard of this opposition for segmental boundaries posited in accordance with traditional notions. The prosodic opposition members in this type of provection coalesce as though no boundary existed.

Moreover, in reality this prosody operates in the functional structure outlined in Table 7.2.b as an independent entity. We could replace all positions of articulation with a variable x without upsetting the basic structure. Indeed, the development of the Welsh affricate subsystem (Griffen 1974b) can be interpreted as the replacement of this variable x by the symbol for the palatal-alveolar order /j/, borrowed from English. Likewise, the development of the voiceless palatal and bilabial

fricatives (see section 7.2) can be interpreted as the replacement of this variable x by the symbols /y/ and /w/, respectively. Thus, we can extend the notion that the prosodic opposition of aspiration operates without regard to segmental boundaries to a stronger one which states that the opposition of aspiration, which forms the basis of the consonant subsystem, operates without regard to segments.

That a consonant subsystem should be organized through a prosodic nonsegmental base brings into question the very notion of the segment in phonology. Indeed, if the basic opposition of our phonological consonant subsystem operates without regard to the boundaries of segments, how are we to define a segment phonologically? More pointedly, if the basis of our system does not need to rely upon the notion of a segment, why is our description couched in the terminology of a segmental phonology? It appears as though we may be unjustifiably restricting our phonology by demanding that the base of the structure depend upon some peripheral notion for its definitions.

What we need to do now is to reexamine the notion of segmental phonology. We may be relying upon a segment which is merely some fiction introduced for the convenience of description. If so, the segment would be a violation of the principles of abstraction, as it would introduce an element to one level of abstraction which is not present on the lower level. As the lower level of abstraction is phonetic, we must examine the phonetic data in order to see what justification there may be for the use of the notion of the segment. Such an examination is also necessary from the inner approach to phonology, which holds that the phonology must reflect the phonetic sounds of the language. This examination is conducted in the next chapter.

NOTES TO CHAPTER 7

¹Items from Fynes-Clinton 1913 have been slightly altered wherever necessary to bring them into line with the notation used herein. As in section 5.2, the symbol for the voiceless stop represents voiceless aspirated, that for the voiced stop represents voiced unaspirated, that for the voiced stop with a dot subscript represents voiceless unaspirated. A circle below any sonorant represents the voiceless cognate.

²In the Welsh phonological system, /s/ is taken to be aspirated. See Table 1.0.c.

³/s/ does enter into relationships in some dialects.

⁴/s/ is not included as it does not enter into phonological relationships in Standard Welsh. It is dealt with in Chapter 9.

⁵The numeral 2 in the citation refers to sentence intonation.

⁶The lines connect the consonants displaying alliteration. The corresponding consonant sounds can be found in Tables 1.0.a-b.

⁷/hy/ represents a palatal voiceless fricative and /hw/ represents a bilabial voiceless fricative (rounded).

⁸As mentioned in section 1.1, the Old Welsh /ɣ/, which would correspond to /gʷ/, and the Old Welsh /β/, which would correspond to the soft mutation of /bn/, were lost in Middle Welsh. Thus, the structure shows inconsistencies of pattern reflecting these historical changes.

CHAPTER 8 AN HIERARCHICAL PHONOLOGY

8.0 The Phonetic Basis of Oppositions. On the phonetically pertinent level of abstraction, as pointed out in section 7.0, the basic element is the opposition. The phonetic opposition occupies an important place in the process of abstraction leading to the development of a phonological structure. As is characteristic of all such processes of abstraction, this basic element enters into relationships of abstraction with the elements of the phonological level of abstraction (that is, the more abstract) and with the elements of the actual phonetic data (that is, the less abstract). Thus, in order to defend one or another phonological system on the basis of the acoustic and physiological data, it is necessary to operate through the phonetic opposition.

The strategic location of the phonetic opposition in the overall structure of the phonology demands that the characteristics of the phonetic oppositions be especially defensible within the notions of abstraction. In order to maintain a high degree of defensibility, it is necessary to introduce a minimum of assumptions along with the abstraction process. The requisite of a minimum of assumptions in the determination of phonetic oppositions can be achieved, so long as those characteristics of the phonetic oppositions on the level of phonetic pertinence correspond to particular characteristics of the actual phonetic data, both acoustic and physiological, in a regular and predictable way.

To be sure, there are assumptions that must be made in the process of abstraction from the phonetic data to the phonetically pertinent oppositions. The most glaring assumption is that acoustic and physiological characteristics constitute the essence through which speech is transmitted. Actually, this is a conclusion which follows from the lack of any viable alternative.

Given the assumption that the acoustic and physiological characteristics form the phonetic data from which oppositions are abstracted, we must determine what characteristics to abstract in order to form particular oppositions. This is usually done by noting which characteristics recur without exception in the production and perception of certain sounds. This method can also be reinforced by methods of synthesis, in which the sounds are synthetically reproduced from devices making use of only the characteristics under consideration. Still, however, this process involves assumptions; namely, that it is a particular characteristic which recurs which is responsible for the sound, and not some characteristic of the characteristic.

This latter assumption involves our present level of sophistication in the area of instrumental phonetics. Until our knowledge of phonetics is expanded, however, we must accept the assumptions of acoustic and physiological phonetics as they are now practiced, if we are going to attempt the construction of any phonology from the inner approach. On the other hand, we must always be prepared to abandon current assumptions whenever our knowledge of phonetics is expanded through experimental results and these assumptions are found to be unjustifiable.

If the phonetic opposition is to be a defensible notion in the abstraction of a phonological structure, it must be correlated with some

characteristics consistent with our present knowledge of phonetics which obtain on the lower level of abstraction. Each correlation between phonetic opposition and characteristic tends to support the opposition in its particularly strategic position in the structure. This supporting evidence can be found in the two established areas of instrumental phonetics--acoustic and physiological phonetics.¹

Over the past several decades, acoustic phonetics has enjoyed a considerable popularity and has afforded significant insights in the field of phonetics. This has been accomplished primarily through the electrical analogs and the instruments produced through them, in particular the sound spectrograph of Koenig, Dunn, and Lacy 1946. Of course, the basis of such systems is theoretical (see Fant 1960), but the assumptions involved in the acoustic theory of speech production should be accepted by the linguist as an expression of the limits of our present knowledge of acoustic phonetics (though, to be sure, such acceptance should be wary).

Much of the effort in acoustic phonetics expended on the problem of finding correlations between phonetic oppositions and particular characteristics has been spent in the determination of vowel sounds. Through spectrographic analysis, for example, it has been determined that the various vowel sounds correspond to formant frequency characteristics (see, for example, Peterson and Barney 1952). These characteristics form the basis of certain phonetic oppositions (Fant 1959, 1962; Jakobson, Fant, and Halle 1952).

Spectrographic analysis has also afforded significant insights into the determination of acoustic characteristics relating to the various consonantal oppositions. For example, such oppositions as

closure and vocal onset time have been correlated with characteristics in the spectrograms of stops (Fischer-Jørgensen 1954; Halle, Hughes, and Radley 1957). Similarly, the various oppositions of fricatives (Strevens 1960; Heinz and Stevens 1961) and of glides (Lehiste and Peterson 1961) have also been correlated with characteristics found in the spectrogram.

The determination of phonetic characteristics underlying consonant oppositions has been greatly aided by such instruments as the playback spectrograph, which allows the experimenter to manipulate these characteristics (see Cooper, Liberman, and Borst 1961). Through the methods of synthesis, phoneticians have been able to make a much stronger correlation between precise characteristics on the spectrogram and the phonetic oppositions. Such characteristics include transitions which vary from consonant to consonant depending to a large extent on the vocalic environment (see Cooper, Delattre, Liberman, Borst, and Gerstman 1952; Delattre, Liberman, and Cooper 1955; Öhman 1966). I return to this notion of characteristics of consonants depending on those of vowels in the next section.

At our present level of sophistication in acoustic phonetics, taking into account the theoretical nature of the analogs, we can find strong correlations between the phonetic oppositions and particular characteristics in the spectrogram, characteristics based upon frequency, time, and amplitude. The fact that these characteristics should maintain a basis in observable and even measurable data is of especial importance in our construction of a phonology through abstraction. Through the use of these acoustic measurements, we can base our abstractions upon concrete items; and as long as we do not violate any principles

of abstraction, our oppositions have a high degree of reliability on account of these concrete items.

The other well-established area of phonetics is physiological phonetics. This branch of phonetics is actually the older of the two, a fact reflecting its greater independence from instrumental methods. Physiological phonetics, as it is known today, began in the last century as articulatory phonetics, especially in the visible speech of A.M. Bell 1899, A.G. Bell 1909, and Sweet 1909 (see also Sweet 1884 on Welsh). The notion of articulatory phonetics was used as a basis in the feature (opposition) systems in American structuralism (compare Bloomfield 1933), as well as most other schools of phonology (phonemics).

More recently, the development of adequate x-ray techniques, and especially of cineradiography (see Öhman and Stevens 1963), has expanded the notion of articulatory phonetics to the more general physiological phonetics. Moreover, in so doing we have acquired a basis for a physiological theory paralleling the acoustic theory of speech production (see Peterson and Shoup 1966).

Such studies as Perkell 1969 not only increase the viability of a physiological theory, but they supply observable phonetic evidence that can be accurately measured. For the purpose of abstracting phonetic oppositions from observable characteristics, this last point is extremely crucial. In Perkell 1969, for example, we find precise physiological characteristics, characteristics based upon space and time. As we find in the measurable acoustic characteristics, we can use these physiological characteristics for the construction of a phonology through the abstraction of oppositions from concrete items.

Both the evidence from the spectrogram and the evidence from the

cineradiogram give us precisely measurable, concrete items from which we can abstract oppositions. Moreover, as these instrumental readings occur in a time-oriented manner, they give us the means of dynamically measuring the actual occurrences of speech, a point to which I return in the next section.

I mention above that acoustic and physiological phonetics form the two established fields of phonetics. There is one other field of phonetics that ought to be noted. This is neurological phonetics. As speech is a function of the neural system (see, for example, Penfield and Roberts 1959), we should also try to find neural characteristics that correlate with phonetic oppositions (compare Lieberman 1970). Although some work has been done in this area (for example, MacNeilage 1970), the field has not yet developed to the point at which we could reliably abstract oppositions from neural characteristics. Nonetheless, we should be prepared to modify our present abstractions on the basis of new developments in this field (compare Reich 1968).

Reviewing the literature of acoustic and physiological phonetics, we find ample evidence to support the notion that certain concrete, measurable characteristics occur in the actual phonetic data which we can use as a basis for abstracting phonetically pertinent oppositions. Oppositions abstracted from these data maintain a high degree of reliability, at the very least. This high degree of reliability should be reflected in the overall structure of our phonology, if we manage to restrict our abstraction process so as to allow a minimum of assumptions in addition to these oppositions.

The danger of introducing faulty assumptions does not lie in the abstraction of the phonetic oppositions (provided we maintain the

correlation with phonetic characteristics), but it lies in our organization of these oppositions into phonetic, and then phonological, structures. Nonetheless, these oppositions must be organized into systems within a structure, for we could not possibly make inferences as to the nature of phonology (and language in general) if we were faced with nothing more than a conglomeration of phonetic oppositions in no particular order. On the phonetically pertinent level of abstraction as well as on the phonologically pertinent level, the oppositions must enter into relations one with another, if we are to construct a functional structure of phonology. Only if these relations are established can we gain some insight into the language.

The organization of oppositions into structures must be based upon some premises. Now there are two ways of forming a basis for the organization. On the one hand, we could organize the oppositions in accordance with notions that create a consistent structure but are not based upon any evidence derived from the observation of some natural relationships that appear to hold between the various phonetic characteristics themselves. Of course, if we cannot find any such evidence of natural relationships between phonetic characteristics, this is our only choice. If, on the other hand, there is some observable set of relationships that obtain between the various phonetic characteristics, then we are obliged by the inner approach to abstract the relationships and use them in organizing the higher levels of abstraction.

8.1 The Organization of Oppositions. The usual manner of organizing oppositions in order to construct a phonological (or phonemic) structure is through the use of the segment. A segmental phonology is based upon

the premise that sound is segmentable. The various oppositions in a given sample of speech can be categorized as belonging to one or another unit of oppositions, each of which is completely included in a segment. Once all of the oppositions are organized into segments, we have a string of discrete segments, or phones.

On the level of phonetic pertinence in such a framework, these segmental phones can be manipulated such that phones which include particular opposition members are grouped together. The usual way of grouping the phones is through the principles of noncontrastive distribution. For example, in English the phone [t^h] occurs in initial position in tonic syllables and contains the aspirated member of the opposition of aspiration; while the phone [t] occurs in initial position in tonic syllables after [s] and with the unaspirated member of the opposition of aspiration. Likewise, from the evidence submitted in the previous chapter, we can group the Welsh phone [d̥] which may occur in word-final position with the voiceless member of the opposition of voice along with the phone [d] with the voiced member of the same opposition.

Having organized the phones into groups of allophones based on the principles of noncontrastive distribution, we can abstract the phonologically pertinent oppositions, those oppositions which are shared by the various members of each group of allophones, in order to form the phonemes. These phonemes form the basic organizational unit of oppositions on the level of phonological pertinence. These phonemes, moreover, can further be grouped in the phonology according to the various opposition members contained in them. The usual way of doing this is through consideration of grammatical function, and the resulting units are known as morphophonemes, which form relations on a yet higher

level of abstraction (or, in some schools, on an equal level with the phonemic).

This method of organization of the oppositions (or features) has a long history in structural linguistics. Indeed, the phoneme of de Saussure (1959:38-49) is constructed along the lines of the abstraction process mentioned above, as is the phoneme as a 'bundle of distinctive features' in Bloomfield (1933:Chapter 5). As we can see in the inherent oppositions of the Prague school (Trubetzkoy 1969), the notion of the phonological segment, though far more abstract, is basically the same there. In more recent developments in phonology, the underlying segment (or representation) of the generative school of phonology (Chomsky and Halle 1968; Schane 1973) is firmly rooted in the segmental-phonemic tradition in spite of the problems involved in deriving continuous speech from these discrete segmental units (see Liberman 1970; Liberman et al. 1967). Although the stratificational approach does not introduce the segmentation process quite as close to the phonetic data as do the other schools, nonetheless there is a phonemic level on which oppositions are ultimately grouped into phonemes for relationships with higher strata (Lamb 1966a, 1966b; Lockwood 1972:Chapter 6--though Sullivan 1975 does make use of nonsegmental description for voice in Russian obstruents). Even in the system-structure approach of prosodic analysis (Firth 1948; Robins 1957) in which the prosodic, nonsegmental opposition figures so prominently, there is still a segmental base in relation to which the prosodies operate.

The history of the segment in structural phonology (or phonemics) has been long, and its influence has, if anything, become increasingly felt throughout linguistics, regardless of the particular theory. We

might expect, then, that the process of segmentation would be fully justified in the construction of a phonological structure. As we see below, however, this is not the case.

One of the basic facts of phonetics is that sound is not in reality segmented. That is to say that we do not hear a succession of discrete segments, but a continuum of sound. The process of segmentation involves a method of organization of oppositions which, to be sure, creates a consistent structure, while not basing this organization upon any evidence derived from the observation of any natural relationships that appear to hold between the various phonetic characteristics underlying the oppositions (compare the previous section and Fant 1962).

The nature of speech sound as a continuum has not gone unrecognized in phonology. Twaddell 1935 recognizes the phoneme not as a real unit of sound, but as a convenient fiction. The concept of a segment being a unit of convenience rather than a real unit of sound is also recognized in Schane (1973:Chapter 1), although some psychological justification for the segment is offered, based on the nature of the western alphabet.²

Indeed, phonologists generally recognize the fact that speech sound is not segmental, that the process of segmentation is merely a method of organization without any basis in the acoustic or the physiological data. Although the lack of phonetic justification in this process does call to question the role of segmentation, the use of segmentation has been necessary in the past because of a lack of any evidence of natural relationships that obtain between phonetic characteristics that could be used in the more abstract levels of the structure. Moreover, further use of the segment in phonology is still necessary unless such evidence

is provided from the fields of phonetics. Again if such evidence is found, then we are obliged by the inner approach and by the notions of abstraction to abstract any relationships that obtain between the various characteristics of the phonetic data which can be used for the organization of phonetically (and phonologically) pertinent oppositions. This is to say that not only the oppositions themselves but the relationships between oppositions should be based upon phonetic evidence wherever possible.

I mention in the previous section that the evidence from the spectrogram and the cineradiogram affords measurable, concrete items from which we can abstract phonetic oppositions. This evidence, moreover, is a function of time, making possible dynamic measurements of the speech event. The development of dynamic measurements of observable phonetic events makes possible the construction of phonetic models for the prediction of those dynamic movements of the physiological apparatus and the formant characteristics upon which these measurements are based.

The successful development of any such dynamic phonetic model constitutes an important contribution not only to the fields of phonetics, but also to the structure of the phonology, for if such a phonetic model is produced, it must have some form of phonetically-justifiable organization between the characteristics from which we abstract the oppositions. This phonetic organization would provide the observable set of relationships obtaining between the various phonetic characteristics needed for abstraction into the higher levels of abstraction. If such abstraction can be performed, we would no longer have to rely upon segmentation for the organization of oppositions. Instead, we could organize the oppositions in a dynamic manner consistent with the observable

data, allowing ourselves a greater degree of correlation between the phonology and the data.

Such a dynamic phonetic model is what we find in Mermelstein 1973. The model constructed by Mermelstein for the production of vowel-consonant-vowel utterances is physiological and is based upon measurements with relation to the jaw, hyoid, tongue body, tongue blade, lips, velum, and maxilla and rear pharyngeal wall.

In this model, the midsagittal dimension is divided into thirty-four sections, and measurements are based upon distances and angles computed from the intersections of lines tangent with the above-mentioned stationary and moving points of reference. Given the target areas of the proposed vowels and consonant, the movements of the pertinent articulators can be computed by the model.

As I mention below, Mermelstein's model is not in itself a surprising development. Indeed, it is a logical step in a series of phonetic developments over the past decade. The main contribution of this model is its mathematical predictability. Although others have suggested the same notions shown by Mermelstein in a hypothetical form (for example, Curtis 1954), it is with this model that the hypotheses have been solidified into predictable calculations that can be empirically tested. As such, then, it necessarily forms an important part of a physiological theory of speech production.

Another important aspect of Mermelstein's model is the notion of hierarchical application of articulatory movements. According to this dynamic model, the trajectory between the first and second vowel of a V(C)V utterance is plotted as a function of time. Given the particular trajectory of the vowels, the physiological characteristics of a given

consonant will apply in a particular order of importance--the movements associated with particular characteristics of most importance to the consonant are applied first, and the rest in order, if possible in the trajectory as modified by the more important consonant movements. In such a hierarchy, for example, stops and nasals produced at the alveolar position of articulation have the tongue tip marked 1 (most important), the jaw opening and tongue body marked 2, and the lip height and lip protrusion marked 3 (least important--articulated only if possible).

Once again, it is the formalism of Mermelstein which is of greatest importance here in the development of a physiological model of articulation. The notion that not all of the articulators actually reach their target areas given certain information about the vowels is a significant development. I should further stress that these orders of application as well as the movements of articulators are not simply predicted in principle, but are computed mathematically. The predictions of movements based upon information relating to the vowels is further enhanced in the model by methods of predicting movements of consonant articulators in consonant clusters.

Mermelstein (1973:1081-2) bases this dynamic model on the following principles:

- (1) The midsagittal vocal-tract outline is modeled in terms of nine selected variables describing the position of the participating articulators.
- (2) Stationary vowels are represented in terms of four variables, two describing tongue-body position, one the jaw position, and one the lip position. Movement from vowel to vowel, expressed as changes in the variable values, is slow and precisely controlled.
- (3) Representation of consonants requires additional control of tongue-tip elevation, lip height, and velar opening. Tongue body or jaw closure is specified by the variables pertinent to vowels.

- (4) Consonants are not defined directly in terms of variable values but by constraints on articulator position relative to the fixed structures. Articulators independent of the specific constraints are free to take on positions independent of the consonant under production subject to the requirement that they do not otherwise constrict the vocal tract.
- (5) Stop consonants are released by rapid movement of the constricting articulator.

The development of Mermelstein's articulatory model is, as I mention above, not the work of one man alone, but the logical extension of a decade of work not only in physiological phonetics but also in acoustic phonetics. I group the developments into two areas: the development of the model and the determination of the consonant-vowel relationships.

In the development of the model, Mermelstein has several predecessors; although, to be sure, these are mainly concerned with static, not dynamic models. For example Heinz and Stevens 1964 uses anatomical measurements to determine a tentative set of rules for computing the area functions corresponding to articulatory configurations. Like Mermelstein's model, this model relies upon rules specified in terms of functions relating cross-sectional areas to linear dimension. It also incorporates the effects of jaw and velum positions.

Coker and Fujimura 1966 constructs a static geometric model which achieves 'reasonable accuracy' for both vowels and consonants. It uses five variables, representing the tongue body and the palate-pharyngeal wall as circles, a practice later adapted by Mermelstein. Mermelstein's use of jaw and lip coördinates, moreover, can be traced to Mermelstein, Maeda, and Jujimura 1971. Furthermore, the work of Lindblom and Sundberg 1971 also figures prominently in the development of the current model.

Many, if not most, of the phoneticians mentioned so far are mainly interested in the acoustic aspect of speech production or in the interrelationships between acoustic and physiological aspects. Progress on the more clearly physiological side includes the findings of Perkell 1969. Perkell's measurements from cineradiographic film are instrumental in the development of the current model, as are the measurements of Mermelstein et al. 1971.

Not all of the phoneticians who contributed to the development of the articulatory model are concerned with merely static models. For example, Öhman 1966 notes that it is necessary to take anticipation into consideration in the construction of any model (acoustic or physiological). Furthermore, Öhman attempts to relate the overlapping movements of the articulators to separate neural instructions (compare Lieberman 1970).

Another important contribution in this area is that of Atal and Hanauer 1971. They by-pass the study of spectra (Fourier analysis) and represent the speech waveform directly in terms of time-varying parameters related to the transfer function of the vocal tract and the characteristics of the source function. In so doing, they find that the linear predictability of the speech wave forms the basis of both the analysis and the synthesis procedures. This development of the time variable in the construction of a speech model is of obvious importance to the type of model introduced by Mermelstein.

The mathematical predictability of Mermelstein's model is, of course, of great phonetic consequence. But it is perhaps of even greater importance to the entire study of phonology that Mermelstein should have based these mathematical calculations on the principle that

consonants are constraints on vowels. This dependence relationship between consonants and vowels, however, is not new with Mermelstein. As with the nature of his model, this aspect of his work is also a logical extension of developments within the field.

In acoustic phonetics, the dependence of consonants on vowels has long been known. The locus and transition studies conducted at Haskins Laboratory, particularly Delattre et al. 1955, establish the fact that aspects of consonant transitions are affected to a great extent by the nature of the vowels in the environment. These variations are predictable, to some extent, as shown by Liberman, Ingemann, Lisker, Delattre, and Cooper 1959.

Indeed, one of the most important findings of Öhman 1966 is that there is a large discrepancy in the realizations of various consonant cues. This discrepancy can be attributed to the surrounding vowels.

A significant review of the literature in this area is found in Liberman et al. 1967. In addition to the review, Liberman et al. propose a model by which speech is coded and decoded (as opposed to being handled as a cipher) by intricate physiological-acoustic-neural mechanisms. Regarding the transmission of consonants and vowels, they propose that these phoneme types are transmitted in parallel, rather than in sequence. Liberman 1970 also presents this argument, basically from an acoustic standpoint.

From a physiological standpoint, perhaps the most important influence upon the current model's approach to consonant-vowel relationships is found in the work of Perkell 1969. According to Perkell (1969:65-6), the effect of the vowel upon the consonant is one of position of articulation, rather than of manner of articulation. Moreover, the deformation of the articulating organ in the production of

the consonant is superimposed upon the vowel (the positioning element) through fast, precise intrinsic musculature. We can see a definite parallel between these findings from cineradiography and the principles upon which the current model is based.

In this respect, Perkell 1969 is in full agreement with Öhman 1967, in saying that the consonant can be described as being superimposed upon continuously varying vowel articulators, a notion central to the current model. Moreover, the findings of Öhman 1967 not only agree with determinations in physiological phonetics, but they provide a basis for the extension of the same dynamic model into the realm of acoustic phonetics.

As I state in the previous section, if there is some observable set of relationships that obtain between the various phonetic characteristics, then we are obliged by the inner approach to abstract the relationships and use them in organizing the higher levels of abstraction. The evidence from physiological and acoustic phonetics will not support an organization of oppositions in the phonology based upon the notions of segmentation, but it will support an organization of oppositions based upon principles of hierarchical application (compare section 7.1). Thus, the demands of the inner approach to phonology leave us no other choice than to abandon the abstraction into segments in favor of some sort of abstraction into a hierarchy of oppositions.

The demands of the inner approach are not merely conventional devices which can be modified for the sake of convenience and simplicity. Rather, the inner approach is a statement of theory saying that phonological structures must be abstracted from real phonetic evidence. Once we are faced with real phonetic evidence which can be abstracted to form

phonological relationships, if we choose to avoid this evidence, we are no longer working within the same theory. More importantly, if we choose to avoid this evidence, we are basing our structure not upon fact, but upon fiction.

The choice, then, between incorporating our new-found evidence from physiological and acoustic phonetics or ignoring it in favor of the traditional segmental-phonemic approach constitutes a choice in the direction which phonology is to take in the future. On the one hand, we can choose to incorporate the organizational structure found in the phonetic evidence, in which case we will be faced with the formidable task of constructing a phonology through some extremely complex relationships. But, however long and however difficult this task, we will be assured that our phonology has a sound, real basis in observable evidence which will afford us insights into the nature of language. On the other hand, we can choose to avoid the evidence and maintain a segmental approach to phonological organization, in which case our investigations in phonology will be much simpler and easy to understand. Of course, along with this simplicity and ease we will also realize that we are working in a fictional realm which cannot afford us insights into the nature of language, but only affords us insights into the nature of the particular model used in description (compare Chapter 6). This is not to say that investigations in the segmental framework cannot be useful in directing our attention to other areas of investigation (indeed, we see this in the phonological evidence of the previous chapter). What I am saying is that investigation in the segmental mode, while occasionally useful, ought not to be confused with investigations relating directly to the sound systems of

real languages.

Most phonologists have realized that the relationships obtained through the segmentation of speech sound do not constitute real evidence. Nonetheless, the segmentation process has been necessary in the past because of the absence of any phonetically justifiable manner of organizing the oppositions into a viable phonological structure. This situation, however, has now been eliminated by the development of phonetic models on an hierarchical basis. It is now the task of the phonologist to formulate a phonological structure on the basis of these hierarchical relationships.

8.2 An Hierarchical Structure in Phonology. In this section I set forth some initial definitions and postulates which may be useful in the construction of a phonological structure along the lines of the phonetic relationships outlined in the previous section and in section 7.1. Such a structure I term an hierarchical phonology. These postulates and definitions are consistent with the findings of Mermelstein 1973 and Perkell 1969 in physiological phonetics and with the findings of Öhman 1966 and 1967 in acoustic phonetics. Moreover, they are consistent with the general phonological theory involving abstraction into levels of pertinence which I have been using in this and the previous chapter.

In stating these postulates and definitions, I use the familiar formula 'x is y'. This is certainly not to be read as an irrefutable observation of tangible phenomena, but should be read 'within this approach, we consider x to be y'. Subsequent research may bring about changes anywhere in this structure; nor should such changes be avoided, so long as these changes are based upon evidence.

The model suggested in these postulates and definitions is based upon the notion (supported by the phonetic dynamic models) that consonants are constraints on vowels. This is to say that the vocalic oppositions are realized in a continuous stream, and various types of consonantal oppositions obstruct the flow of this stream. We may thus consider such notions as a consonantal opposition member obscuring a vocalic one such that the vocalic opposition member is acoustically altered in some way (is no longer 'clear'). In such a system, consonants cannot exist separate from vowels.

The vocalic pattern is a continuous stretch of speech from one vowel approximation to the next, interrupted only by constraints on the vowels themselves. Physiologically, this represents continuous movement of variables relating to tongue-body position, jaw position, and lip protrusion. So long as the movement of these variables is not altogether terminated in the speech function (that is, in communication), one vocalic pattern is maintained.

Acoustically, the steady movement of vowel-determining articulators is representable in terms of formant continuity. If the formants on a spectrogram are either continuous or their gaps, produced by constraint rather than termination or total interruption of the speech function, can be interpolated, then one vocalic pattern is maintained.

A vocalic pattern may be as short as, but no shorter than, a sustainable sound the size of a syllable or as long as a breath group (compare Lieberman 1967), or, indeed, as a discourse block. It is not a subset of a reasonably determinate set of possible vocalic patterns (although, to be sure, the number is finite).

A syllable is a member (or unitary member) of a vocalic pattern.

It is characterized by a vowel approximation. In physiological terms, this vowel approximation corresponds to the target area of a vowel at which a steady state harmonic sound could be emitted. In acoustic terms, it is an area of the spectrogram in which formant frequencies are definable by poles and zeros (see Fant 1956), and in which a steady-state set of frequencies is approximated (though not necessarily achieved). Although the syllable cannot be obscured physiologically (that is, the vocalic articulators always maintain their positions regardless of consonants), it can be effectively obscured by obstruction acoustically (such as the Mandarin syllable 四 [sɿ] 'four', which has no 'pure' unobscured vowel sound). Nonetheless, some formant patterns can be discerned in all syllables. A syllable may be the shortest sequential unit (see Malmberg 1955; Liberman et al. 1967).

The vocalic oppositions are measurements of physiological and acoustic variables. Whether physiological or acoustic variables are used in any description is not a matter of one's supremacy over the other, but reflects rather the demands of the particular description (Lieberman 1970). Indeed, the choice ought not to be an exclusive one.

As the vocalic pattern is traced from syllable to syllable, movement from one vowel approximation to the next will cause functional movement in the physiological vocalic variable and in the acoustic formant patterns. These transitions are relatively slow and form the boundary areas of syllables. Quicker transitions are not syllable boundaries but elements of obstruction or restrictions and are associated traditionally with consonants and glides (Lehiste and Peterson 1961).

A vocalic restriction (associated with glides) is a medial transition (faster than a syllable boundary but slower than an obstruction element).

It commonly accompanies a length of reasonably steady vocalic emission, but it is too short itself to maintain a steady state. As the vocalic restriction is medial in nature, a change in tempo (deliberate or incidental) can cause the restriction to be alternatively realized as a syllable, a syllabic boundary (if it corresponds to the following syllable), or an obstruction element. This is demonstrated in Lehiste and Peterson 1961.

Obstructions vary according to language and, conceivably, to idiolect. Basically, an obstruction is a constraint on the vocalic pattern that occurs intersyllabically. During the obstruction, the physiological vocalic variables may be slightly constrained, but they continue in the vocalic pattern, and acoustically the transition from syllable to syllable can be interpolated mathematically (Öhman 1967). The obstruction is characterized (that is, the basis of the opposition is identified) as a particular position of articulation or acoustic locus.³

In some languages, there may be degrees of obstruction, such as total obstruction (1st degree--closure), partial obstruction (2nd degree--frication), and minor obstruction (3rd degree--sonorance). Other languages, however, may operate in a way such that some of these degrees of obstruction are determined by prosody (as I show for Welsh in the next chapter). Lower degree obstructions may last for entire syllables (such as the Mandarin word cited above). Just what is a lower degree obstruction, of course, is dependent upon the structure of the particular language.

Obstructions are not consonants in the segmental sense, there being no such thing in this nonsegmental phonology. They are particular

constraints on the vocalic pattern that occur not sequentially with the vocalic pattern but concurrently with it and superimposed upon it. However, they are in sequence with each other. Thus, the nature of the vocalic variables in the syllable transition will determine to a great extent the precise manner of occurrence of the obstruction (as it lacks its own base for articulation), and it will, by virtue of its demands on articulators and acoustic locus requirements, affect the nature of the vowel upon which it is imposed in a predictable (phonetic) manner, but in a manner of less magnitude than that of the vowel on the obstruction. Of course, the notion of allophonic (combinatory) variation becomes an hierarchical matter rather than a sequential one and is to be handled phonetically (that is, it is calculable from the formulae of Mermelstein 1973, Öhman 1967, etc.).

In addition to the vocalic pattern, syllable, and obstruction, there is a series of prosodies. A vocalic pattern prosody includes the notion of intonation and consists of fluctuations in stress and pitch, among other things (see below). The actual position of occurrence of these fluctuations will depend upon prosodies of other levels of the structure, notably those in words (which I do not define).

A syllable prosody is a realization of a particular quality for the duration of a syllable. Such prosodies include tones, tunes, pitch, and stress. As the basis of the syllable is vocalic, there is no issue as to whether syllable prosodies occur on the nucleus alone. Such prosodies occur in the syllable and may be obscured by an obstruction of a high degree (1st degree and possibly 2nd degree, depending upon the language).

Vowel oppositions are, by the nature of the syllable, syllabic

prosodies, such as height and frontness (physiologically) or compactness and gravity (acoustically). These prosodies can affect or alter those of dependent syllables in such phenomena as umlauting (vowel affection) and harmony. This is accomplished by the dominant syllable prosodies (vocalic oppositions) altering transitions which, in turn, affect adjoining syllable prosodies. (Note that the method is continuous--there is no hopping of segments by oppositions.)

The most intricate set of prosodies is the set of obstruction prosodies (compare Trubetzkoy 1969:146). Like other prosodies and obstructions, the obstruction prosody is superimposed upon the vocalic pattern and is, as such, a constraint. These prosodies are associated with the obstructions, however, and may dominate part or all of the syllable.

Obstruction prosodies can include tension, aspiration (the inverse of voice--voice is, after all, an inherent quality of the vocalic pattern and cannot be a constraint upon itself), nasality, and so forth. In some languages, as mentioned above, the obstruction prosody of tension, or prosodic tension, can determine the difference between stop and fricative (as in Welsh--see Griffen In press a; sections 6.1 and 7.2, above).

More than one obstruction prosody can occur at one time. For example, the Welsh nasal affricate in / ŋ^{h} ain/ '(my) chain' includes an apico-palatal-alveolar obstruction, a prosodic aspiration that is initiated concurrently with the onset of obstruction and dominates beyond the release of obstruction, and prosodic nasality that will vary considerably among speakers and dialects, conceivably lasting into the second obstruction (dominating the entire syllable). Moreover, an

obstruction prosody need not occur in conjunction with any (phonological) obstruction, as in French un /ø/ 'one', and in the 'glottal fricative' /h/ (preaspiration).

In cases such as whispered or nasalized speech (where it is considered phonetically or phonologically pertinent), the obstruction prosody is superimposed upon the entire vocalic pattern. Thus, it is classified as a vocalic pattern prosody in this instance. Where nasality, for example, is a vocalic pattern prosody, it can be in addition imposed as an obstruction prosody (such as in nasal speech). Whispering is prosodic aspiration superimposed upon the vocalic pattern.

The final opposition is the notion of speech itself, the weaker member of which is the absence of speech--breath. Breath is characterized by aspiration (voicelessness) of *a lenis* and possibly nasal manner (although, for purposes of markedness, it is considered to be nonnasal) in the absence of a vowel. Hence, it is prosodic without obstruction. Unlike whispering, breathing is characterized by a steady physiological state with articulatory apparatus in neutral position (the /H/ of Gleason 1961; or the voiceless schwa). Of course, the absence of the vocalic pattern in breath defines the lack of speech.

Because of its prosodic nature, in languages in which tension is contrastive (possibly through aspiration, as in Welsh), breath can spread prosodic lenition (which may involve 'voice'--the reduction of aspiration) over final obstruents in anticipation of the lenis nature of breath; while in languages in which 'voice' (that is, lack of aspiration) is contrastive, it can spread prosodic aspiration over final obstruents. Thus, we find the peculiar situation of archiphonemic neutralization of 'voice' in word-final position in German and Welsh

being realized in opposite ways (see sections 6.2 and 7.0).

All restrictions, obstructions, and prosodies are realized by degree. The degree of realization, or constraint, is determined by such considerations as the rate of speech as well as by predictable considerations dictated by the environments. Of these predictable considerations, the type of hierarchy shown by Mermelstein (in 'marking' articulators) figures prominently.

The division between phonology and phonetics in this nonsegmental, hierarchical system is, of course, not a matter of segmental versus nonsegmental. In this system, mathematically predictable and calculable values such as the exact range of a prosody or the precise degree of an obstruction become the realm of phonetics, while functionally contrastive combinations and extents of constraints and vocalic values become the realm of phonology. Moreover, the difference between an opposition of phonetic pertinence and one of phonological pertinence is still a matter of contrast and predictability, as outlined in section 7.0.

Using these postulates and definitions, we should be able to construct an hierarchical phonological structure. The details of the phonological structure of a particular language depend, in the final analysis, on the particular oppositions found in the data of that language. Thus, although the principles of abstraction of oppositions and relationships inherent in the postulates and definitions are general, the resulting structure will be particular.

8.3 Toward an Hierarchical Phonology. A theory of language (or of some part of language) consists of certain principles concerning the

nature of language. Through these principles, the linguist forms hypotheses and checks these hypotheses against the theory (for consistency) as well as against the data of the object of study. Hypotheses which adhere to the observations and to the theory are then formed into a model, from which the linguist constructs grammars.

The theory of hierarchical phonology states that the process of abstraction into levels of pertinence can be accomplished from phonetic characteristics in order to construct a phonological structure. As such, then, the theory is by no means new. In fact, it is nothing more than the traditional theory of phonology through the inner approach (Jakobson and Halle 1962; Trubetzkoy 1969). The postulates and definitions of the previous section constitute the hypotheses consistent with the theory and (assuming the accuracy of phonetic evidence) with the observations. From these hypotheses, we can construct a model, or a phonology. By applying this model to the data from a particular language, we can construct a grammar of the phonology of that language (as in the next chapter).

As the theory of which hierarchical phonology is a model is the same theory that has traditionally been used with the inner approach (a combination of abstraction theory and opposition theory making up the functional/structural approach of Prague), and as my methods of using the theory in the construction of a model and a grammar are likewise traditional and (supposedly) known to all linguists, why, one might ask, do I go through the exercise of repeating them here? The reason for this lies in the confusion between model and theory. In recent years, it has increasingly become the practice of some linguists to construct a particular model within a particular framework

(that is, adhering to certain hypotheses of organization) and then to defend this model as a theory, such that an attack upon the model is construed as an attack upon the theory (compare Chomsky 1965:24).

I wish to avoid this misconception that an attack upon a model is an attack upon the theory, a misconception predicated upon the notion that they are isomorphic one with the other. Two decades ago, Hockett 1954 pointed out that three frameworks, three entirely different models, could be constructed from the same structural theory. Indeed, since that time, linguists using one or another model have attacked the other models of the same theory, acting as if they believed their attacks to be directed against some alien theory. The most harmful development has not been in the attacks (which are always beneficial, so long as they are to the point), but in the defenses, in which the proponents of one model or another defend even the most indefensible aspects of their model, believing (apparently) that this is an action necessary to save a theory of known value.

Considering the history of the model-as-theory misconception, I should like to emphasize the relationship between the theory and a model. The model which I construct in this section on the basis of the hypotheses of the previous section is, I believe, more consistent with the theory and the observations than most (if not all) other models within this functional/structural theory. If, however, any aspect of this model or the model itself can be shown to be less consistent with the data and the theory than some other aspect or, indeed, some other model entirely, then I shall not defend the particular weak aspect or the model. In so doing, I defend the theory. On the other hand, a refusal to prune the model wherever necessary actually constitutes an

attack upon the theory, albeit unwitting.

The dispensability of a model is a logical necessity of linguistics. The reason for this is the abductive nature of model-construction (compare Anttila 1972:Section 9.16; H. Anderson 1973). Within a logical syllogism, the major premise is the theory, the minor premise is the model, and the conclusion is the observation. Given a particular theory and a set of observations, we have the major premise and the conclusion. We now must determine the model, or minor premise. This process of abduction is by far the weakest logical operation we can conduct, for a given observation can be accounted for from a given theory by any number of models, few of which will be sufficient in the final analysis in their original forms. We must, therefore, maintain a high degree of flexibility in our construction of models and take special pain to eliminate all inconsistencies with the theory and the observations.

The model which I propose from the postulates and definitions of the previous section (the hypotheses) is the hierarchy shown in Table 8.3. This model represents a particular structure of phonology consistent (tentatively) with the theory and the observations.

In this model, the oppositions in the higher levels are superimposed upon those in the lower levels. The structure is divided into three general divisions. The vocalic pattern division provides the basis for the representation of the pertinent level (phonetic or phonological) in the abstraction of the speech event. The syllabic division serves to organize the vocalic pattern into sequential order and forms a basis for the obstruction division.⁴ The obstruction division constrains the vocalic pattern in accordance with the sequential order of the syllabic division.

Table 8.3
Hierarchical Model

Obstruction Prosody Obstruction	Obstruction Oppositions (‘Consonantal’ Oppositions)
Syllable Prosody Syllable / Transition, Restriction	
Vocalic Pattern Prosody Vocalic Pattern	Vocalic Oppositions

Basically the same organizational structure can be used for the phonetic and the phonological levels of pertinence. The difference between the two, as stated above, is one of predictability versus contrast.

In the construction of a grammar for the phonological system of a particular language, we organize the oppositions in accordance with these various divisions and levels. In describing different languages, we will probably have to adjust the basic model, and such an adjustment could serve as a statement of the organization of the particular language. In the next chapter, I describe the consonant system of Welsh within this model.

NOTES TO CHAPTER 8

¹The following excursus is a very basic survey of the literature and development of the field of phonetics. It is provided for the convenience of those readers who have not kept up with the literature.

²Of course, the alphabet was invented only once (compare Gelb 1963).

³Position of articulation implies tongue configuration in addition to place of articulation.

⁴There may be redundancy in these two divisions, a matter which will have to be determined in a later study of vowel phenomena.

CHAPTER 9 AN HIERARCHICAL DESCRIPTION

9.0 Theoretical Implications in the Application of the Model. As I point out in the previous section, a model of a particular theory consists of a set of hypotheses which we use to relate the theory to the observations. If we consider the theory to be the major premise and the observations to be the conclusion, the abduction of a model from the hypotheses requires a construction which satisfies elements of the theory as well as elements of the observations.

The hypotheses and model considered in the previous chapter satisfy (tentatively) the elements of theory as well as observations. Turning to the sounds of a particular language, however, we find an entirely different logical operation. We must accept, at least temporarily, the model and the theory--in logical terms, the two premises. In this operation, we apply the model to the abstracted oppositions of the particular language in an attempt to deduce the observations. If the deduced observations correspond to the actual behavior of the language, then we can consider our phonological structure to be valid. If this correspondence is not found, then the structure is invalid and must be changed.

The process of applying the model to a particular language involves, then, the logical operation of deduction. This operation involves a development of the argument from the theory and through the model, in order to arrive at specific observations. Such a process involves the

development from general to specific.

Thus, we find a process whereby deduction verifies abduction. This is not, however, all that is involved. Before we can arrive at a theory, we have particular observations, and these observations are made with respect to a primitive model, which reflects those aspects of the observations which we consider, for one reason or another, to be important. The construction of a theory, then, involves the formation of a major premise in a syllogism from the minor premise (the primitive model) and the conclusion (the observations). This process is induction.

The formulation of a linguistic structure is subject to all three logical operations--induction, abduction, and deduction. These operations, moreover, must be applied continuously, for each new development must be reconciled within the entire structure (compare Mulder 1968:1-7). Once every element of the structure is logically defensible, then the entire structure is valid. Of course, validity ought not to be taken as the 'discovery of truth' (compare Robins 1957; also Chapter 6, above).

The dependence of the three parts of a linguistic structure, the theory, the model, and the application of the model (the grammar), upon the relationships represented by the three logical operations should not be taken lightly. In spite of claims made by one school of linguistics or another, it is no more possible to create a linguistic structure purely from deduction (a theory created without considering any observations) than it is to create one purely from induction (gathering data with no idea of what it is that is being gathered). This point is an important one to remember, as we attempt to apply the model to a particular language in order to construct a grammar consistent

with observations, for if, in the deductive process, the structure falters, then we should not hesitate to reapply the operations of abduction or even of induction in order to rectify the structure. Although we cannot change the observations and we avoid changing the theory, the model and its application in the grammar must remain flexible.

Having considered the relationships that obtain between the various parts of the structure, we have yet to address the practical side of the problem--the construction of the grammar. The grammar is the application of the model to the particular language. In this case, we are concerned with the application of hierarchical model (Table 8.3) to the consonant (or obstruction) oppositions of Welsh.

As noted in the previous chapter, the oppositions are abstractions from the phonetic data. Without some sort of organization, however, these oppositions can tell us little concerning the structure of the phonology. It is the model which supplies this necessary element of organization. By applying the model, then, we simply mean that we organize the oppositions into a grammar.

The result of the application of the model is a functional arrangement of oppositions. This functional arrangement is peculiar to the particular language, for no two languages will have exactly the same oppositions and opposition members and exactly the same relationships holding between the various oppositions and opposition members. This peculiar functional arrangement of oppositions comprises the phonology of the language.

There are two senses of the word 'phonology'. One pertains to the structure of the sound system of one particular language. This

phonology is represented in the grammar of the language. On the other hand, phonology can also be used to designate the general notions embodied in the model. Thus, the phonology of Welsh, for example, adheres to the requisites of a general phonology.

The relationship between the two notions of phonology raises the subject of the general versus the specific, or the universal versus the nominal. Although much attention has been given to this subject, as far as the practical problem of applying the model is concerned, it does not matter whether we consider the universal to be the common abstraction from the nominals or whether we maintain an ideal universal toward which all nominals strive. This subject is a philosophical one, to be argued as a matter of faith, and ought not to interfere with scientific investigation. As mentioned above, we ought not to limit ourselves to investigation from the general to the specific (deduction) or from specific to general (induction), but we should use all logical operations in order to establish a valid structure without philosophical prejudice.

In applying the model for the construction of a grammar, there is one other question which, in the light of recent linguistic practices, should be addressed. How formal and explicit should the structure be? When the structure is complete and the relationships have been established, some explicit formalism will suggest itself. To burden the linguist prematurely with an explicit set of formalism, however, would be to remove much of the needed flexibility from the linguist's operations. Such reliance upon a preconceived set of formalisms would suggest a final structure which may very well be inadequate. The formalism used herein, then, should not be taken as a necessary part of the notion of

hierarchical phonology, but merely as an aid to conceptualization, to be changed or discarded at will.

9.1 The Welsh Consonant Subsystem. In applying the hierarchical model to the Welsh consonant subsystem, we find two groups of consonant oppositions. First, we have the obstructions, which directly constrain the syllabic oppositions and the vocalic oppositions proper. Second, we have the obstruction prosodies, which are superimposed upon the obstructions or upon their areas of constraint in the syllable transitions.

As mentioned in section 8.2, the obstruction can be classified by degree depending upon the nature of phonetic realization. In Welsh, we can further classify the obstructions by the extent to which these degrees are realized through interaction between the obstruction and the prosodies. The primary obstruction is that which can be described by point of articulation only. It is the only one which maintains a realization of the 1st degree obstruction and enters into a full set of relationships with the obstruction prosodies.

As with all obstructions, the primary obstructions are members of a gradual opposition of position of articulation. This position of articulation is a function of the point of articulation and the articulator configuration, and it can be determined both physiologically and acoustically. Since in Welsh there is no archiphonemic neutralization within the opposition of position of articulation, a determination of degrees of strength in the opposition cannot be made on the basis of neutralization. Nor, indeed, can such a determination be made on the basis of naturalness (in the manner of Trubetzkoy 1969), as all positions of articulation involve deviation from the state of breathing of

approximately equal degree.

Within the primary obstructions, there are (in Standard Welsh) three members of the opposition. These are the labial (the bilabial and the labio-dental), the (apico-)dental, and the (dorso-)velar. Just for the sake of conceptualization, I use the following notations to represent these opposition members: /b/, /d/, /g/, respectively. As I state in the previous section, the notation is not to be taken as restrictive and is basically unimportant.

The secondary obstructions are more restricted than the primary obstructions. They cannot be described by point of articulation alone, but rely also upon articulator configuration. Moreover, they do not maintain a 1st degree obstruction, and they are not as fully developed in their relationships with the obstruction prosodies (see Table 9.1.b). Within the secondary obstructions, there are two members of the opposition. These are the lateral and the trill, for which I use (again, just for the sake of conceptualization) the notations /l/ and /r/, respectively.

Finally, there is the tertiary obstruction. This is the most restricted classification. Like the secondary obstruction, it requires description by both point of articulation and articulator configuration (the full function of position of articulation) and maintains no obstruction of the 1st degree. Unlike the secondary obstruction, it enters into only one relationship with one obstruction prosody (the minimum for articulation). In Standard Welsh, the only opposition member of the opposition of position of articulation in the class of tertiary obstructions is the 'apico-alveolar slit fricative', designated by the notation /s/.¹

In the opposition of position of articulation, there is only one

case of structural discrepancy between the phonetic and the phonological levels of abstraction. This discrepancy is found in the labial member of the opposition (/b/). Phonetically, the 1st degree obstructions are bilabial and the 2nd degree obstructions are labio-dental in Welsh. The fact that there are no conflicts between the two degrees (that is, there are no 1st degree labio-dentals or 2nd degree bilabials) shows that the difference between the two points of articulation is not contrastive. Thus, phonologically both degrees can simply be considered as labial (compare the principles of noncontrastive distribution).

Superimposed upon the obstruction or directly upon the syllable transition is a class of oppositions known as the obstruction prosodies. These prosodies are not inherent in the obstructions, nor do they form some larger units with the obstructions (compare Chapter 7). In Standard Welsh, there are two obstruction prosodies--nasality and aspiration.

In Welsh, the prosodic opposition of nasality is privative. The notation /n/ represents the nasal member of the opposition, and the nonnasal member is not overtly indicated. If the nasal member of the opposition of nasality is present, the velum is lowered allowing air to pass into the nasal cavity, resulting in the characteristic distribution of acoustic energy. If, on the other hand, the nonnasal member of the opposition is present, the velum is not lowered and the characteristic distribution of acoustic energy is not effected. As an obstruction prosody, pertinent nasality is not affected by nasality as a vocalic pattern prosody, such as one finds in the nasalized speech of the Caernarvon district.

While saying that the opposition of nasality is privative, I recognize that it is possible to perceive in Welsh some differences in

degree of nasality, particularly in conjunction with aspiration. I would maintain, however, that this is not a result of a gradual opposition of nasality, but merely the effect of aspiration operating in conjunction with it.

The prosodic opposition of aspiration in Welsh is treated in some detail in Chapter 7, and I do not want to repeat the detail of that chapter here. Suffice it to say, however, that the opposition of aspiration is a gradual opposition, realized in four degrees of strength (or presence). For the sake of convenience, I represent the first degree (the weakest) with the notation / u /, the second degree with the absence of notation (or / \emptyset /), the third degree with the notation / h /, and the fourth degree with the notation / hh /. As always, I choose the particular notations simply because they are convenient to the subject which I am discussing (that is, historical changes in the Welsh language to the 'voiced unaspirated stop'). I could just as easily represent the opposition members as / 1h /, / 2h /, / 3h /, and / 4h /.

In the structure of Welsh phonology, the prosodic opposition of aspiration is of prime importance, as evidenced in Chapter 7. Because of the importance of this opposition and of its gradual nature, I treat the phonetic evidence supporting the opposition in Chapter 10.

The two groups of oppositions (obstructions and prosodies) in the obstruction division (that is the consonant subsystem) do not simply coexist. They enter into relationships in order to produce the various 'sounds' of Welsh. These relationships consist of one member of the obstruction opposition and one member of either prosodic opposition or of both prosodic oppositions. These relationships can be economically described through the use of the three degrees of obstruction, mentioned above.

The nasal member of the prosodic opposition of nasality may enter into a relationship with any of the three primary obstructions, but there is a restriction on the relationships with primary obstructions into which the nasal member may enter. Nasality can only be realized relative to a primary obstruction of the 1st degree. In traditional terminology, nasals in Modern Welsh can only be cognate with 'stops'. Moreover, nasality in Welsh can only be realized with an obstruction (though, to be sure, such realizations are possible in other languages, such as French and Portuguese--compare section 8.2). Of course, this restriction does not apply to Old Welsh, insofar as the realization of the nasal opposition member in a relationship with an obstruction of the 2nd degree is concerned, as we do find the bilabial nasal fricative in positions of soft mutation (compare Morris Jones 1913:163).

The relationships into which the various members of the prosodic opposition of aspiration may enter are far more complex than those of the nasal opposition member. All four members of the opposition of aspiration may enter into relationships with any of the three primary obstructions. When the first (or weakest) member of the opposition of aspiration enters into a relationship with an obstruction, the result is described in traditional terms as a 'voiced fricative'; when the second member enters into a relationship with an obstruction, the result is described traditionally as a 'voiced unaspirated stop'; when the third member of the opposition enters into a relationship with an obstruction, the result is described traditionally as a 'voiceless aspirated stop'; and when the fourth (strongest) member enters into a relationship with an obstruction, the result is described traditionally as a 'voiceless fricative'. Again, phonetic justification for these relationships is

given in the next chapter.

There is one apparent restriction in these relationships between members of the opposition of aspiration and the primary obstructions. When the weakest member of the opposition of aspiration enters into a relationship with the velar member of the obstruction opposition, phonetically the realization is null. Phonologically, however, the realization may be described through the notation /g^u/. This acts as a place-holder in the phonological structure, and its identity is functionally important, especially as we consider the system of alternations in the next section.

As demonstrated in section 7.2, the first (weakest) member of the prosodic opposition of aspiration may enter into a relationship with the secondary obstructions. The realization of this relationship in traditional terms is a set of 'liquids'.² The relationship between the second member of the opposition of aspiration and the secondary obstructions is open to some interpretation. Based on the evidence of Chapter 7, I have maintained this relationship in order to establish what is traditionally known as the 'voiceless lateral and trill fricatives'.

On the other hand, one can also find evidence to support the notion that /ɬ/ and /ɮ/ are the realizations of a relationship between a higher member of the opposition of aspiration and the secondary obstructions. First of all, there is the fricative nature of the relationship, suggesting the fourth opposition member. Moreover, in some dialects, there have been reports of an aspirated lateral liquid as aspirate mutation form for the lateral liquid (Professor Ceinwen Thomas, University of Wales at Cardiff, personal communication, notes this in informants from Rhoshirwaun and Llannerchymedd, both in Gwynedd).

In these dialects, at least, we would find a more complex set of relationships.

As noted above, there is only one relationship between the opposition of aspiration and the tertiary obstruction. The second member of the prosody enters into a relationship with the tertiary obstruction, such that the realization of this relationship can be described in traditional terms as the 'voiceless slit fricative' or the 'voiceless sibilant'. The reason why I consider this relationship to involve the second member of the prosodic opposition is that in certain South Welsh dialects one does find a 'voiced' variant ([z]) which in some cases is contrastive (see, for example C. Thomas 1964) and suggests a set of relationships patterned after those found in the secondary obstructions.

Unlike the nasal member of the opposition of nasality, aspiration can occur without entering into a relationship with a member of the obstruction opposition. In this event, the opposition takes on the nature of a privative opposition (either there is preaspiration or there is not), and the aspirate member of this opposition assumes the characteristics of the syllable transition on which it is superimposed.

Not only do the prosodies relate with the obstructions, but they also relate with each other. In fact, such a relationship between the prosodies is obligatory in Welsh if the nasal member of the opposition of nasality is to be realized. In saying that the nasal member of the opposition of nasality can only be realized in relationship to the primary obstructions of the 1st degree, we are actually saying that the nasal opposition member can only occur in a relationship with the second and third members of the opposition of aspiration, for it is the occurrence of the opposition of aspiration which serves to differentiate obstructions

of the 1st and 2nd degree in Welsh.

Due to this dependency relationship between the opposition of nasality and that of aspiration, we can base the restrictions placed upon the opposition of nasality at least partially upon the aspirate prosody. We can thus restate the above-mentioned restriction as follows: The nasal member of the opposition of nasality is restricted to the primary obstructions constrained by the second or third member of the opposition of aspiration. If, for some reason, a primary obstruction were to be constrained simultaneously by the nasal member of the opposition of nasality and by the first (weakest) member of the opposition of aspiration, the nasal member simply could not be realized. This is an important consideration in the alternation system, as we see in the next section. Once again, this only applies to Modern Welsh, not to Old Welsh.

On account of this restriction placed upon the prosodic opposition of nasality, we might wish to make a further partition in the obstruction division. This restriction would enable us to consider the nasal prosody to be a constraint upon the aspirate prosody as well as upon the primary obstruction. Thus, in our description of Welsh phonology, we could place nasality above aspiration (consistent with the hierarchical model in Table 8.3). Of course, such a device would be a convenience for conceptualization, while the notion of constraint would be a statement of the structure of the phonology.³

Now that we have defined the relationships between the various members of the oppositions in the obstruction division, we can construct a grammar representing the consonant subsystem of Welsh. This grammar represents those members found in Standard Welsh and can be conceptualized

in Table 9.1.a. In this table, we find the members of the various oppositions in the hierarchical order consistent with the hierarchical model and the data (Table 8.3).

Table 9.1.a gives the members of the oppositions, but not the relationships into which these members enter. These relationships are shown in Table 9.1.b. This table can be read as follows: The nasal member of the opposition of nasality may constrain (enter into an hierarchical relationship with) the second or third member of the opposition of aspiration and (simultaneously) with any primary obstruction. Any member of the opposition of aspiration may constrain any primary obstruction. The first and second member of the opposition of aspiration may constrain any secondary obstruction. The second member of the opposition of aspiration must constrain the tertiary obstruction.

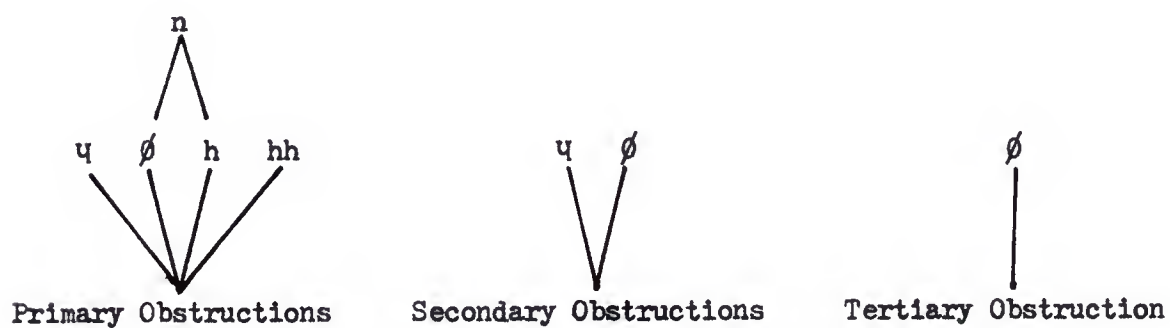
As far as the individual realizations of these relationships is concerned, we need only refer to Table 7.2.b, above. The only change which we might want to make in this table is to shift all notations so that they conform to the vertical arrangement of Table 9.1.a. Of course, such a change is only a convenience for conceptualization, and it would have no real bearing on our analyses.

One point that needs to be prominently stressed is that the notation is not the notion. Although such a point may be readily understood, linguists in the past have often confused the two, particularly when these linguists have been working in schools with highly-developed notational systems. For example, one occasionally hears a generativist saying that stratificational grammar is just a 'notational variant' of transformational-generative grammar. Of course, to those who are acquainted even in the slightest with the notions of the two schools,

Table 9.1.a
The Obstruction Division of Welsh
(Consonant Subsystem)

n				}	Prosodic Oppositions
ɥ	∅	h	hh		
b d g (Primary)	l r (Secondary)	s (Tertiary)		}	Obstruction Oppositions

Table 9.1.b
Welsh Consonant Relationships



such a statement is absurd. On the other hand, to the linguist who knows the notions of one school and sees similar notational devices in the other, the confusion between the two schools can be quite convincing. (Compare Anttila 1972:Section 17.1.) I stress this point, because I use notational devices traditionally associated with several different schools, and the use of these notational devices here should in no way be construed as isomorphic with the use of these devices in other schools. For example, the notation /g/ used herein only serves to designate the velar member of the opposition of position of obstruction and does not represent closure or voice, as the same notation does in some other schools.

Nor should any juxtaposition between any notational devices be misconstrued as representing a process relationship or derivation. Although I would not rule out any use of process at this point in the development, I would not require that relationships be based upon this notion. Such a requirement would thwart the flexibility of the system (compare Chapter 6 and section 9.0).

One aspect of the system which should be apparent from the notions presented in this section is the high degree of interdependence between and independence of the various opposition members in the obstruction division (indeed, this should be the case throughout the entire grammar). As far as the interdependence of the opposition members is concerned, no constraint upon the vocalic pattern can be realized without the realization of one member of the prosodic opposition of aspiration. Thus, the obstruction opposition member is dependent upon the prosodic constraint. Moreover, it is further dependent upon this constraint for the realization of the degree of obstruction (1st, 2nd, or 3rd).

As far as the independence within the system is concerned, we find a high degree of variability within the classifications of obstruction opposition members. By labeling the classifications in Table 9.1.b rather than listing the members, we effectively state that these relationships will hold regardless of the actual member realized.

This last point of variability can be seen in the development of the Welsh affricates (see Griffen 1974b). As a primary obstruction is one in which closure can be realized, the English affricates borrowed into Welsh would naturally fall into this classification. The fact, then, that in some dialects [č] alternates with [č̥] and the fact that in one dialect [č] also alternates with [č̥h] and [č̥] with [h̥] can be adequately explained and even predicted through an hierarchical grammar of Welsh. The new primary obstruction /č̥/ is merely entering into established relationships. Indeed, if this development did not take place, then the borrowing of the affricates could be considered anomalous.

The relationships explained in this section should adequately describe the consonant subsystem of Welsh. The question now facing us is whether this system of relationships can describe alternations and historical change, particularly those described in the previous chapters. After all, it would hardly be considered proper to criticize one model, only to replace it with another model with the same faults (although, to be sure, that would not be without precedent).

9.2 Mutation, Lenition, and Provection. The relationships shown in the previous section for the consonant subsystem of Welsh provide us with a structure through which to consider synchronic alternations and historical changes. I should first like to address the system of

alternations known as the mutation system (see Chapter 1).⁴

On the first, phonetic, level of abstraction, we abstract oppositions from the basis of characteristics found in physiological and acoustic evidence. This abstraction is on a level of phonetic pertinence, on which these oppositions serve a phonetic function (representing the transmission of communicative sound). On the second, phonological, level of abstraction, we abstract oppositions from the phonetic level which serve a contrastive function in communication. In the third, morphophonological level of abstraction, we abstract oppositions from the phonological level of abstraction which serve a grammatical function in communication.

Unlike the lower two levels of abstraction, however, the morphophonological level of abstraction, at least at this point in the development of the phonology, does not have a structure such as that found in Table 8.3. Moreover, there are no notations for entities of morphophonological pertinence. The reason for this seemingly underdeveloped state of morphophonology is that there are no entities, no members of oppositions, on the level of morphophonological pertinence. A 'morphophoneme' in this approach is the statement of a relationship that obtains between members of an opposition of phonological pertinence, a relationship that reflects a grammatical function (while contrast serves a communicative or semantic function). Thus, the level of morphophonological pertinence is in one respect more abstract than and in another respect equally as abstract as the level of phonological pertinence.⁵

The Welsh mutation system is a morphophonological system in that it is a system of relationships between various members of the oppositions of aspiration and nasality reflecting certain grammatical relationships.

Before we can investigate the actual morphophonemes of Welsh mutations, we must first establish the grammatical relationships. These relationships are precisely those described in Chapter 2. In the hierarchical approach, however, we address the environments of Chapter 2 through a system of markedness (in the Prague sense).

The application of markedness to the grammatical environments of the mutation system is really quite simple. If a grammatical context corresponds to the realization of soft mutation, we can say that the context is marked for soft mutation. If it corresponds to the realization of nasal mutation, it is marked for nasal mutation. If it corresponds to the realization of spirant mutation, it is marked for spirant mutation. And if it corresponds to the realization of aspirate mutation, it is marked for aspirate mutation. Now if the grammatical context does not correspond to the realization of any mutation, we can say that the context is unmarked.

The application of this grammatical markedness to the morphophoneme is somewhat more complex. If the grammatical context is unmarked for mutation, then there is no morphophoneme, no relationship at this level between one member of either the opposition of aspiration or the opposition of nasality and another member of the same opposition. If, on the other hand, the grammatical context is marked for, say, soft mutation, then there is a morphophoneme which represents a relationship between the member of the opposition of aspiration or nasality which would be realized if the grammatical context were unmarked and that member of the opposition of aspiration or nasality which is in fact realized.

The difference between the hierarchical approach and the generative approach of the first five chapters is significant. First of all, the

morphophoneme of hierarchical phonology is not an item, but a relationship; while, on the other hand, the underlying segment of generative phonology is an item. The system of markedness in the grammatical context relates to the morphophonological level of pertinence in the hierarchical approach, but in the generative it is the grammatical environment which motivates a derivation from the underlying segment. Indeed, the entire structure of the hierarchical phonology is established upon the basis of relationships coexisting in a system, not upon the generative notions of cause-and-effect, directional derivation from one item to another.

The absence of items in the morphophonological relationships of hierarchical phonology must be stressed. In abstraction theory (see, for example, Korzybski 1933:Chapter 25), we cannot abstract an item--only a quality of the item or notion about it. The items of phonology exist only in the actual acoustic and physiological events of speech (and, of course, in the neural connections employed in speech). Thus, we abstract oppositions from characteristics found in acoustic and physiological measurements, measurements which are abstracted from the events themselves. As mentioned in section 8.0, the process of abstraction is reliable so long as we avoid adding assumptions to the system in the process of abstracting.

The abstraction theory used here differs sharply from the approach found in the generative feature system. In the generative approach to phonology, the feature is an item found on the underlying level, and the value of the item may be changed or replaced through a series of processes until it becomes the phonetic event (Chomsky and Halle 1968:294). In this approach, then, the phonetic feature is just as

concrete an item as the acoustic-physiological event itself. Unfortunately, the underlying segment is an abstraction of the distinctive features, making this underlying level a level of abstraction. How an actual item can be abstracted onto a level of abstraction has never been explained, especially as regards unrealized 'abstract' segments.

In hierarchical phonology, soft mutation can be described as a morphophonological system relating the unmarked opposition members to their marked counterparts in the opposition of aspiration, the marking here corresponding to grammatical context. If in the unmarked context, a primary or secondary obstruction is constrained by the second or third member of the opposition of aspiration without being constrained by the nasal member of the opposition of nasality (except in the case of the labial obstruction constrained by the second member of the opposition of aspiration), then in the context marked by soft mutation, the obstruction is constrained by the next lower member of the opposition of aspiration. Thus, for example /bh/ alternates with /b \emptyset /, or [p] with [b] in the traditional notation.

These relationships must adhere to the consonant relationships outlined in the previous chapter. When we say, then, that the soft mutation morphophonemes relate the unmarked member with the next lower member of the opposition of aspiration, we must take into account restrictions placed on consonant relationships. Thus, as the /q/ member of the opposition of aspiration constrains the /g/ member of the obstruction opposition such that the phonetic level realizes null, the realization of soft mutation in the morphophoneme relating unmarked /g \emptyset / with marked /gq/ relates to the realization of null on the phonetic level. Likewise, as the nasal member of the opposition of nasality

cannot be realized with the /ɥ/ member of the opposition of aspiration, the realization of soft mutation in the morphophoneme relating unmarked /bn/ (or /b~~ɔ~~n/) with marked */bɥn/ is actually realized /bɥ/ and is realized as such on the level of phonological pertinence.

By maintaining the notion that morphophonological relationships must adhere to the structure of the phonology, we avoid one of the major problems that has plagued generative phonology, particularly with relation to the soft mutation rules of section 1.1. The generative systematic phonemic rule operates through processes. When the processes would create a segment which does not exist, the rule must be constrained or another rule must be added. With the hierarchical morphophoneme being firmly established upon the structure of the phonologically pertinent level, we can establish relationships on the basis of what is actually permissible, thus avoiding the rather awkward false steps of Zwicky 1974. Moreover, this approach also renders non-existent the problem of rule ordering, as no external devices are needed in order to relate one part of the structure with another.

Nasal mutation is structurally the same as soft mutation. In this type of mutation, if in the unmarked grammatical context a primary obstruction would be realized constrained by the second or third member of the opposition of aspiration, then in the context marked by nasal mutation the obstruction is further constrained by the nasal member of the opposition of nasality. Thus, for example, /bh/ alternates with /bhn/, or [p] with [mh] in the traditional notation.

Likewise, in spirant mutation, if in the unmarked grammatical context a primary obstruction would be realized constrained by the third member of the opposition of aspiration but not constrained by

the nasal member of the opposition of nasality, then in the context marked by spirant mutation the obstruction is constrained by the next higher member of the opposition of aspiration. Thus, for example, /bh/ alternates with /bhh/, or [p] with [f] in the traditional notation.

In aspirate mutation, the situation is a little different, though the structural application of the morphophoneme is the same. If in the unmarked grammatical context no obstruction would be realized constraining the initial syllable transition, then in the context marked by aspirate mutation the transition is constrained by the aspirate member of the privative opposition of aspiration. Thus, null alternates with /h/.

Thus, we see that all of the Welsh mutations may be described through the use of hierarchical morphophonemes relating members of prosodic oppositions. Because of the construction of the phonology along obstruction-prosodic lines, no more than one degree of any one prosodic opposition is involved in any morphophoneme, nor is more than one prosody involved in any one morphophoneme. This system, then, is more regular than the generative system of process relationships criticized in section 6.1, in which conflicting processes create one major class from another.

Moreover, the hierarchical phonology does not rely upon mechanical devices to insure the establishment of relationships. Thus, in the event that unforeseen sets of relationships need to be established in order to make generalizations about the structure of the phonology, there should be no external devices prohibiting these relationships.

There is another type of mutation, traditionally known as 'hard mutation'. As pointed out in sections 5.1 and 6.2, this traditional

term is used to refer to archiphonemic neutralization in word-final position, in which 'stops' lose the contrastive function in the opposition of aspiration, and the second member of the opposition of aspiration is realized for all primary obstructions of the 1st degree.

This archiphoneme is like a morphophoneme in that it is not an entity but a relationship holding between members of an opposition. The archiphoneme, however, differs in an important way from the morphophoneme. While the morphophoneme is dependent upon a notion of grammatical function corresponding to phonological realization, the archiphoneme is dependent upon a notion of contrastive function corresponding to phonological realization. This functional difference between the two types of relationship should not be treated lightly, for it has its roots in the very difference between grammar and meaning (or semantics).

It is with respect to the archiphoneme that we find the notion of phonological marking most evident. Phonological marking is found in contrastive oppositions and may be compared with the Prague notion found in Trubetzkoy 1969. As each individual language maintains its own phonological structure, or grammar, markedness depends in the final analysis upon the particular language. In Welsh, markedness within the gradual opposition of aspiration is gradual, such that between any two members of the opposition, the weaker is the unmarked and the stronger is the marked. In word-final position, then, we can say that there is a position of neutralization such that if a primary obstruction of the 1st degree is to be realized, it can only be realized with the weaker, second member of the opposition of aspiration.

In this system, we avoid the many problems encountered by generative phonology with respect to archiphonemic neutralization. By recognizing

a contrastive function as well as a grammatical function, we can differentiate between relationships with phonological correlates and those with grammatical correlates (compare Griffen 1974a). More importantly, by establishing a phonological structure with phonologically and phonetically pertinent levels of abstraction, we can make generalizations about the way in which the language operates without having to relate this language with a preconceived set of universal markedness notions which, in reality, prohibitively conflict with Welsh.

Traditionally related to the notion of 'hard mutation' is provection. Now the aspirate and geminate provection discussed in section 7.2 can be described through the use of the opposition of aspiration, as demonstrated in that section. Here we may find it convenient to describe provection through a process relationship. If aspiration spreads its dominance from the initial transition of one syllable to the final transition of the preceding syllable and if, in addition, a primary obstruction constrained by the second member of the opposition of aspiration is constraining the final transition of this preceding syllable, then the aspiration merges with the second member of the opposition to create the third member of the opposition of aspiration constraining the obstruction (for example, the realization of ei mab hi as [i mha: pi] 'her son' in section 7.2). Likewise, if two identical primary obstruction members both constrained by the second member of the opposition of aspiration should occupy the same position in the syllable, then the obstructions should merge and the two second members of the opposition of aspiration should combine, creating a single third member (for example, tebyg gennyf as [tebik kin i] 'I suppose' in section 7.2). Where the range of dominance of a prosody is concerned, process relation-

ships can be useful, but we ought not to limit ourselves to such process relationships. Indeed, any particular type of relationship must be considered tentative. Of course, these processes are not derivations from deep to surface structures.

Thus, the synchronic alternations of Welsh can be handled through an hierarchical phonology. Such a description, moreover, affords a considerable degree of flexibility and avoids the pitfalls mentioned in Chapter 6. The question remains, however, as to whether it can handle the phenomena of historical change. I examine here the two most common types of historical change in Welsh, lenition and provection.

As discussed in section 6.0, the nature of historical change ought not to be confused with the method of describing it. The actual 'change' (if we can call it that) is a system of correspondences between one generation of speakers and the next. As it does with synchronic alternations, the hierarchical phonology relies upon the structure of the phonologies of both generations involved to describe the change.

An historical change can be described in the hierarchical approach through a relationship structurally similar to the morphophoneme and archiphoneme. The change serves to relate a member of a particular opposition used in one generation to the member of the opposition corresponding to it used in a subsequent generation. Although there is a structural resemblance between the synchronic alternations on the one hand and the historical changes on the other, the functional difference between the two is of over-riding importance.

As mentioned above, the morphophoneme is a relationship between one opposition member and another based upon a grammatical function, and an archiphoneme is a relationship between one opposition member

and another based upon a contrastive function. The historical change is such a relationship based upon an historical function. As the use of one opposition member or another in the morphophoneme serves to convey grammatical information and the use of one opposition member in the archiphoneme serves to convey information about contrast and markedness, the use of one opposition member or another in the historical change serves to convey information about the particular structure employed, whether it be of one historical period or another.

Historical lenition, then, is an historical change which relates a particular obstruction constrained by one degree of aspiration used in one generation to a corresponding obstruction of a subsequent generation constrained by the next lower degree of aspiration. Likewise, historical provention is an historical change which relates a particular obstruction constrained by one degree of aspiration used in one generation to a corresponding obstruction of a subsequent generation constrained by the next higher degree of aspiration.

By using a relationship with a function of time, this approach more closely parallels the actual event of an historical change. Moreover, by differentiating between functions of grammar and of contrast on the one hand and functions of time (generations) on the other, we manage to draw a meaningful distinction between the synchronic and the historical.

Furthermore, the hierarchical approach provides us with a set of relationships between the synchronic and the historical such that direct comparisons can be made between the structures of the phonologies of different generations. This set of relationships can function as a panchronic statement of the language after the fashion of Welch 1975.

The general type of relationship used here to demonstrate the historical change as a function of time can also be employed in other areas of linguistics. For example, we can form relationships between structures of different dialects and different styles within the same dialect.

The fact that these different types of relationship are structurally similar can lead to greater insights insofar as these different types relate one to another. For example, in section 1.0, I point out that phonological change during the transition between Brythonic and Old Welsh gave rise to the morphophonological system of mutations. As both the change and the morphophoneme can be described through the same structural relationships, this hierarchical framework affords us greater insight into just how such a situation may come to pass. The notions of functionalism found in the hierarchical approach insure that we can receive the benefits of structural similarity with the safeguard of functional difference.

Finally, with respect to historical change, I should like to address the notion of teleological principles. The hierarchical structure, being quite similar to the Prague approach, provides us with a system of relationships which, as we see with the affricates in the previous section, tends toward maximal systematicity, or symmetry. Such a tendency provides us further with the basis for a teleological principle, such as that found in Jakobson (1962:1-2, 2-116, 202-20). Through the avoidance of too extensive a formalism, we further maintain the flexibility needed to use such teleological principles.

9.3 The Deviation. In the previous section, we examine the 'regular' alternations and historical changes and find that an hierarchical approach to phonology can insightfully describe such situations. In the deviation, as discussed in Chapters 3 and 4, however, we find alternations and historical changes which are not quite 'regular', at least not as they are described in those two chapters. An adequate description of Welsh, then, would have to account for the deviation.

As far as the exceptions and counter-examples of section 3.0 are concerned, the generative practice of marking the lexical items is quite similar to the hierarchical approach to this sort of problem. Rather than marking a lexical item alone, however, we can make a grammatical context unmarked given particular elements in the context. By making the context unmarked, rather than marked, we eliminate any use of a morphophoneme in the context. Although the two methods of accounting for exceptions and counter-examples appear to be structurally similar, the notions underlying the difference in approach to marking is fairly significant. Whereas the generative will specify a rule and then act to restrict the rule or add another, the hierarchical, like the Prague and stratificational approaches, will accomplish the task by specifying and using relationships that exist within the structure only. This practice avoids the overgeneralization-and-restriction tactics which lead to the awkward false steps.

The difference between the generative and the hierarchical approaches to the deviation is somewhat analogous to the difference between the approaches to exceptions and counter-examples. First of all, in the generative approach to the phonology of Welsh, the deviations holds an important position. By using the process framework, the generative

phonologist can compare the various surface realizations and 'reconstruct' an underlying voiceless aspirated stop, as we see in Chapter 3. Because the voiceless aspirated stop is not realized in the unmarked environment (environment I), we must use a minor rule deriving the voiced unaspirated stop from the underlying voiceless aspirated stop. Synchronically, this minor rule must be applied every time the item bearing the deviation is to be generated in environment I.

It is in the area of historical change that the deviation is most important within the generative framework, as pointed out in Chapter 4. The addition of the minor rule has been a gradual process in the sense that the inclusion of the rule in individual grammars has occurred gradually over several centuries and the rule has generalized gradually to include all points of articulation. The historical change has not affected the underlying segment, though, but has only added a rule to the grammar.

This approach to the deviation reflects the total reliance upon the process rule. The only way the generative phonologist has to relate the various mutation forms is through derivation from a common underlying form. Thus, although a change has indeed occurred historically, the phonologist must repeat the historical change every time the item is to be derived. If this process is not repeated for every derivation after the change (cases of restructuring aside), then the entire structure of the phonology as it is established in a process framework will collapse.

On the other hand, the hierarchical phonology is not totally dependent upon process relationships. This independence, moreover, is reflected in the fact that the phonological structure is far more

concrete than that of the generative model in general, as well as with respect to the deviation.

In the hierarchical approach to the phenomenon of the deviation in synchronic terms, we should recognize an important similarity between the various words that reflect the phenomenon: They are all function words. This fact is important because function words are dependent upon the grammatical contexts in which they appear to a far greater degree than are content words. For example, when one encounters the word [gan] in one context and [a xan] in another, one should note that the meaning and the grammatical function of each word is determined by the context. Thus, one is liable to learn these function words as separate entities in separate contexts. On the other hand, when one hears the words [pobl] and [bobl], content words with the meaning 'people', one is liable to consider them as variants of the same form, because the meaning is constant--unaffected by context.

This attitude toward the difference between function words and content words is strongly supported by the evidence presented in Chapters 3, 4, and 5. When [gan] replaces [kan] as the radical form, no change is found in the mutations. When [bobl] replaces [pobl] as the radical, however [vobl] replaces [bobl] as the soft mutation form. I should contend, then, that there are no mutations of certain function words productively employed in Welsh--each word is learned in its appropriate context.

In an hierarchical approach, then, what we find in the synchronic manifestation of the deviation is really no deviation at all. Morphophonemes do not apply to function words. We can tell a function word by its particular function in the structure of the language. Both

aspects of hierarchical phonology which make this analysis possible--the flexibility of the relationships and the ability to distinguish between productive and nonproductive forms--are impossible in a generative approach, for the generative model must rely upon process rules to derive variants from the underlying form of a 'single word' and cannot distinguish functional differences in its explicit formalism.

As we turn to the historical aspect of the deviation, we find simply a classical case of historical change, as it is described in the previous section. Taking the change from Old Welsh [kan] to Modern Welsh [gan], for example, we find an historical change relating the third member of the opposition of aspiration constraining the velar member of the obstruction opposition in the speech of one generation to the second member of the opposition of aspiration constraining the velar member of the obstruction opposition in a subsequent generation. The generalization of this change, as described in section 4.1, can be accounted for in our teleological principle stating that the structure tends toward maximal systematicity (and economy--compare Martinet 1955).

A significant advantage of the hierarchical approach over the generative lies in the fact that the hierarchical description describes a change once, at the time that the change is in fact effected. There is no need to repeat the change every time the word is to be realized in every subsequent generation.

The deviation is the point of entry in the generative description for the notion of a Welsh consonant shift (compare section 5.0). It is this problem, after all, which gives rise to the minor rule. The question ought to be asked as to whether or not the change viewed through an hierarchical phonology is of such overriding importance.

That there is an historical change involved, there is no doubt. We see this in Chapter 4. The change consists of the correspondence between an earlier primary obstruction constrained by the third member of the opposition of aspiration and a later one constrained by the second member. This is quite in keeping with markedness notions and is not at all 'irregular'.

It is doubtful that this type of change represents some sort of tension within the phonology pressuring other instances of the third member of the opposition of aspiration to relate through a temporal function to instances of the second member. First of all, when we cease to view the language through the process rules of generative grammar, we lose the 'evidence' that the process of the change is constantly in use in the synchronic grammar.

To be sure, the change has been productive, in that it has indeed generalized to the entire class represented by the primary obstructions and has generalized to a large class of function words. But the productivity of this type of change ought not to be overrated. The tendency to relate the third and the second member of the opposition of aspiration temporally may not affect all words and may very well be due to some further influence.

For example, the prepositions are usually in a nontonic position in the vocalic pattern. The weakening of the opposition may be a function of the position in the stress pattern (vocalic pattern prosody), not a function of the position in the word. We see an example of this in the phenomena involving lenis initials in Welsh borrowings. As I point out in Griffen In press a, the change from the weakest member of the opposition of aspiration (tension) to the second member is a

function of the position of occurrence--and this occurrence is in content words and tonic position.

A much more pointed example with respect to the change in the deviation is found in sentence adverbials. As noted in section 2.2.aa, all sentence adverbials are considered in the environment of soft mutation. Thus, we find the adverb gynt [gɪnt] 'formerly' and ynghynt [ɛŋhɪnt] 'quicker, earlier'. Of course, to say that soft mutation has applied rather than some instance of historical change sometime in the past cannot be substantiated, for one never finds *[kɪnt] used as an adverb. Thus, we can say that adverbs have undergone an historical change (sometime before the coining of ynghynt). And we can say the same with respect to those other function words which exemplify the 'deviation'. Such an analysis makes no claims that the behavior of gan and the others represents a sweeping change in word-initial position. In the hierarchical approach, then, the deviation represents a change of no greater importance than any other change.

9.4 The New Welsh Consonant Shift. A pattern of change, when analyzed through a framework that does not (and, indeed, cannot) take into consideration the notion that structures correspond to functions, appears to be indicative of complex relationships and continuous pressure for change in the system. On the other hand, when the same pattern of change is analyzed through a framework that accommodates the notion that structures correspond to functions, that language is both systematic and communicative, then this pattern of change appears to be little more than routine.

The loss of special status in the deviation due to the consideration

of more flexible bases of relationships and of various aspects of the communicative function of language raises a question as to the validity of the claim that a consonant shift is in progress in the Welsh language. As pointed out in section 6.0, the proof of the shift in the generative framework does not suffice for a proof of the shift in the language, unless we can demonstrate that the generative model is sufficient for the description of the language.

As shown in Chapter 8, the hierarchical model maintains a closer relationship with the actual phonetic data. This is accomplished by strict controls on the abstraction of oppositions, abstraction of the hierarchical order recently determined by phoneticians to be a characteristic of speech, and the avoidance of assumptions in the process of abstraction and construction of the phonological structure. In this chapter, moreover, we see that the hierarchical model can be used to describe the synchronic alternations and historical changes in Welsh in a way which eliminates the points of weakness found in the generative description. Thus, inferences based upon this model should be far more reliable than inferences based upon the generative.

In Chapter 5, the notion that there is a consonant shift in progress in Welsh is totally dependent upon inferences based upon the generative model. Now that we have eliminated the weaknesses in description which result in the weakness in the inference, we must ask whether the inference, like that of the deviation, is capable of surviving without the notational devices and the extra-linguistic assumptions. In order to determine the reliability of this inference, we must reexamine the findings of Chapter 5 in the hierarchical model.

In section 5.1, we find a 'word-final voicing' phenomenon which is

taken to represent the spreading of the minor rule. This phenomenon, however, is also described in that section and in section 6.2 as the realization of the unmarked opposition member in a position of archiphonemic neutralization. As we see in the data of Pilch 1958 and in section 7.2, the phenomenon in question is not 'word-final voicing' or even the neutralization of the opposition of voice, but the neutralization of the opposition of aspiration. Voice in such a language as Welsh is of secondary, phonetic, pertinence (compare Trubetzkoy 1969:76-7).

The phenomenon found in word-final position is changed in the hierarchical approach, but the hypothesis is in no way weakened. In fact, it is strengthened, if anything. In an hierarchical approach, we find an archiphoneme (see section 9.2) relating the weak second member of the opposition of aspiration to the strong third member. As is the nature of the archiphoneme, the contrastive function obtaining between the second and third opposition members is 'neutralized', or lost, and the second member of the opposition is realized in the position of neutralization. Thus, especially in continuous speech (compare Trubetzkoy 1969:262 and section 7.2, above), the degree of aspiration is lost and 'voice' is in most cases realized. What is occurring, then, in the hierarchical description is not a loss of voicelessness with many Modern Welsh exceptions, but a loss of one degree of aspiration without exception in Modern Welsh (I return to this below)

By considering the function of the phenomenon of neutralization in word-final position, then, we may very well see ever-more clearly the weaknesses of the generative model, but we also see that, given the reliability of an hierarchical description, there does appear to be an important development in the Welsh language. This development is

the loss of the contrastive function of the second and third members of the opposition of aspiration constraining the primary obstructions (obstructions of the 1st degree). In traditional terms, there is a loss of contrast between 'stop' cognates. Now this is not an unrestricted historical change marked by the temporal function in language, but an archiphoneme marked by the contrastive function of language. Nevertheless, as we see below, this loss of contrast has important implications.

In section 5.2, we find some cluster and intervocalic phenomena which support the notion of the minor rule. Looking first at the cluster phenomena, we find in Standard Welsh certain developments in just what is permissible and what is not in consonant clusters as far as voice and aspiration are concerned. Again, voice is only of phonetic pertinence, so we should concentrate on the phenomena as they affect aspiration. We find several positions in which the second and third members of the opposition of aspiration contrast, and other positions in which we find only the second member of the opposition. Moreover, from the inherited words and from borrowings we can see that the second and third members cannot maintain contrast in these positions--only the second member is realized. Once again, we find an archiphoneme, precisely on the basis as the one found in word-final position. The phonological context may be more complex than in the archiphoneme above, but the fact that context, or position (as opposed to grammatical function), is the determining factor (or, more precisely, the coexisting one) indicates that we indeed have an archiphoneme.

In the intervocalic data presented, we cannot say that we have found an archiphoneme, for an archiphoneme operates with regard to a position and not with regard to a particular word or set of relationships

existing between certain words. What we find here is simply a classical case of historical change. For example, in the [teked] > [teged] change, we find an historical change relating the third member of the opposition of aspiration constraining the velar member of the obstruction opposition in one generation (/gh/) to the second member of the opposition of aspiration constraining the velar member of the obstruction opposition in some subsequent generation (/g \emptyset /). Now the fact that the uninflected form is [teg] and not *[tek] can form a relationship with the historical change--the relationship of analogy, a function of systematicity. By introducing the analogy, we further show the weaknesses of the generative framework in historical linguistics, for the generative model cannot in its explicit formalism refer to analogy, so any change must be weighed equally with any other change. In the hierarchical model, on the other hand, an historical change related to an analogy tends to serve the contrastive function of speech, not to suspend this function, as we find in the archiphoneme. As I show below, such a change, based only upon analogy and without suspension of contrast, cannot be used as evidence for a consonant shift, at least not in an hierarchical model.

In section 5.3, we examine the phenomena found in word-initial position classified as the gan-type change and the pobl-type change. As we see in the previous section, the gan-type change is a case of historical change. However, if this change can be connected with the particular position in the vocalic pattern, probably a nontonic position such as in clitics (though this is purely hypothetical), such a change may be related to an archiphoneme. In such an archiphoneme, contrast between the second and third members of the opposition of aspiration constraining the primary obstructions would be suspended, such that only

the second member would be realized. Such an archiphoneme, though, would not be realized because of the position in the word, but because of other considerations (such as position in the vocalic pattern combined with notions of function).

In the content words, we find very little evidence at all for a consonant shift. To be sure, there is the pobl-type change, described in section 5.3, but this description is made without regard to contrastive function. A closer look at this sort of change shows that this is a simple case of historical change, of little consequence to the notion of a consonant shift. For one thing, the simple change relating the third member of the opposition of aspiration constraining the labial member of the obstruction opposition in one generation (/bh)/ to the second such member in a subsequent generation (/b \emptyset /) is of little importance, because this change is isolated. Unlike the generative description, an hierarchical description can take this into account through an examination of the function of contrast. So long as the phonological structure maintains contrast between the second and third members of the opposition of aspiration constraining the primary obstruction (of the 1st degree) in word-initial position of content words, any pobl-type change may be simply a case of random change, for the maintenance of the contrastive function in the phonological structure actually thwarts any sweeping changes of the magnitude of a consonant shift. Moreover, the pobl-type change does not exhibit any change in the structure of the phonology, for the morphophonemes relating to the mutation system remain intact, a point of importance as shown below.

Insofar as the mutation morphophonemes and the phonological structure are concerned, I should also mention briefly the changes noted in the

Tŷ Ddewi dialect. The middle generation shows a distinct loss of contrast between the nasal member of the opposition of nasality constraining the third member of the opposition of aspiration and that constraining the second member of the opposition, resulting in the loss of the stronger member from the structure (for example, /dhn/ > /dn/, or [nh] > [n] in the traditional notation). This is indeed a shift, in which all of the former nasals become realized as the latter. The subsequent 'loss of the nasal mutation' in the younger generation is not a loss of the morphophoneme, but the relationship of the morphophoneme to nasality. Thus, the corresponding nonnasal members are realized--those which, due to the above shift, occur with the second member of the opposition of aspiration. The generative use of the minor rule here merely reflects the demands of the system of notation and process, in which the former 'deep' underlying segment must be reconstructed in order for processes to apply in an orderly fashion.

As can be seen in the treatment of the change in the Tŷ Ddewi dialect, the central notion in any hierarchical description of a consonant shift concerns the maintenance of the contrastive function in the phonologically pertinent level of abstraction (the level of contrast). In this framework, there are three factors involved in a consonant shift. The first factor is the loss of contrast between two members of an opposition. Using the existing relationships discussed in the previous section, such a loss of contrast could be described through the use of an archiphoneme. The extent of the archiphoneme in the various positions in the vocalic pattern corresponds to the extent of the shift, whether it be a shift with a restricted environment or one with an unrestricted environment.

This factor reflects a 'natural' process in the development of a consonant shift in language. In the development of a shift, we find one generation with a phonological structure such that two members of a given opposition serve a contrastive function--represent two 'sounds'. In a subsequent generation, these members of the opposition cannot serve the same contrastive function, if we are to say that a shift has occurred, for if they did, the structure would remain the same and there would be no shift, no change, at all.

The fact that we cannot have in a shift a simple relationship of historical change but need an archiphoneme leads to the second factor in the hierarchical description of a consonant shift. There must be a systematic restructuring of consonant relationships; that is, the structure of the oppositions in the grammar (compare section 9.0) must change, and this change must be reflected on the phonologically pertinent level of abstraction. By a systematic restructuring, I mean that the complete system of phonological relationships of the grammar of one generation must correspond to a different complete system of phonological relationships of the grammar of a subsequent generation.

Now this structural requirement corresponds to a functional requirement by the nature of the phonological system upon which it rests. Any change in the phonologically pertinent level is going to be reflected in functional changes in the system of contrast. Thus, a consonant shift can in no way be confused with a 'rephonemicization', a simple change of phonetic correlates of phonological relationships without any structural change. By using the notions of function and contrast together with the notion of phonological structure, an hierarchical phonology can make such a distinction.

The final factor in the description of a consonant shift in the hierarchical approach is the presence of the temporal function. This is to say that we can only refer to a shift between two generations (not necessarily adjacent), if the one generation has the one structure and the other generation has the different one. Although the presence of an archiphoneme in the structures of a succession of generations may imply a restructuring and a shift at an earlier time, we cannot claim that a shift has taken place during that particular succession of generations, for, insofar as that particular succession of generations is concerned, no function of time is served.

These three factors not only provide us with procedures for describing consonant shifts, but they also serve as a teleological principle for the prediction of consonant shifts. As we examine the system of relationships between the various consonant oppositions in Welsh, we find that there is a finite (although, to be sure, a large) number of possible oppositions that could be used to describe the structure. Changes would occur with respect to these oppositions and in keeping with markedness notions, such as those of Trubetzkoy 1969.⁶

We have reviewed the arguments of Chapter 5 in an hierarchical approach and have determined the factors needed to demonstrate a shift in this approach. The main question before us has yet to be answered, though. Is there a consonant shift in progress in Welsh? To answer this question, at least as far as the hierarchical approach will take us, we must interpret the evidence by the criteria of the method.

On the positive side of the question, there has definitely been a loss of contrast. We see this in the archiphonemic neutralization occurring in word-final position, certain cluster positions, and the

rather nebulous area of word-initial position of (nontonic?) function words. If this is a shift, however, it cannot be a shift with an unrestricted environment (compare section 5.0), for it is not complete. Word-initial position of content words, certain other cluster positions, and intervocalic position still support the contrastive function between the second and third members of the opposition of aspiration constraining primary obstructions (of the 1st degree). To be sure, there have been some changes, as we see in the pobl-type changes and the analogies, but at present these are not archiphonemic in nature, and in describing a consonant shift, the notion of archiphonemic neutralization is of utmost importance (where the archiphoneme is opposed to the morphophoneme--compare also Griffen 1974a).

We may have here a consonant shift with a restricted environment. As I point out in section 5.0, such developments in a language can lead to situations as we find in Modern Danish, in which the two members of the 1st degree obstructions serve a contrastive function only in word-initial position. Welsh could be affected in much the same way, with the shift restricted possibly from certain tonic considerations in the vocalic pattern.

There are also some positive and some negative aspects in the answer to the second fact. Where the neutralization has occurred, there has been a systematic restructuring of the relationships pertaining to the second and third members of the opposition of aspiration constraining a primary obstruction (1st degree). Thus, there is a tendency toward the development of a different structure without functional contrast between these two opposition members. If such a loss of contrast were to continue unabated, in keeping with our notions of

teleology, we could say that a shift would be inevitable.

Once again, however, the incomplete nature of the neutralization provides diverging evidence. So long as contrast is maintained in some position in the vocalic pattern, then the entire structure of the phonology must remain intact. If the structure of the one generation corresponds in relationships to that of a subsequent generation, we cannot say that there has been a shift, at least not in an unrestricted environment. Of course, to describe a shift in a restricted environment, we must leave the structure of the consonant oppositions proper and treat their relationships with the vocalic (syllabic) oppositions as well.

The pobl-type change is merely a manifestation of random historical change as it stands now in the development of Welsh. It may be fruitful, however, to consider what would be involved if the position of neutralization should in some future generation include word-initial position of content words. On the basis of the pobl-type changes to date, the loss⁷ of the functional contrast between the second and third member of the opposition of aspiration constraining a primary obstruction in a case where there is a morphophoneme would probably lead to the effectual loss of the spirant mutation. Indeed, all mutation morphophonemes from the former radical would be replaced by those of the newer radical (constrained by the second member of the opposition of aspiration). Thus, the tendency in the system would be to shift all members of the opposition of aspiration one position in the structure, while the fourth member of the opposition of aspiration would remain. This would in effect eliminate the third member from subsequent grammars. Thus, we would see a change in several relationships (compare Grimm's Law). Such a situation has not yet occurred, but given the neutralizations

which have so far occurred, it is a possibility.

Perhaps the one greatest factor militating against such a change concerns the temporal function and a situation which is external to the Welsh language. Although the tendency is there, in order for the shift to be complete, the shift must be reflected in the phonology of some generation. Thus, we do not have a shift at this point. Whether the shift will develop more completely in the future depends upon the future of the relationship between Welsh and English.

In the past century, the English occupation of Wales has been marked by a conscious attempt to Anglicize the country, particularly through education (compare W.R. Jones 1966), to a degree far in excess of previous centuries. As we see in Griffen 1974b, the reliance of Welsh-speakers upon English in the bilingual situation can indeed result in historical changes in the Welsh phonological structure. As English maintains a strict contrast between aspirata (which may include tenuis) and media, in traditional terms, the effects of bilingualism could well be the maintenance of the same contrastive function in Welsh. Of course, such a conclusion is still open to doubt, as the study of bilingualism is still fairly young and it has only been a quarter of a century since the 'coexistent phonemic systems' hypothesis of Fries and Pike 1949, which has been to some degree refuted in the study of Welsh.

The development of current phenomena into a consonant shift depends to a great extent, then, upon the future of the Welsh culture. If the process of Anglicization continues with the preëminence of English in the bilingual situation, then I should not expect the shift to progress. Indeed, according to Professor T. Arwyn Watkins (personal communication), if the present process continues, there may very well not be a Welsh

language by the end of the next century. On the other hand, if there is a reversal in the process of Anglicization and Welsh becomes pre-eminent in Wales, then I might expect the shift to progress, at least to a status equal with the situation in Modern Danish. According to Professor Ceinwen Thomas (personal communication), there is in fact some evidence to support a resurgence of Welsh even in the most Anglicized areas. Thus, the linguists examining this phenomenon must consider the sociological situation as well as the linguistic and must correlate the two in any future conclusions.

In any case, the determination of the progress of the shift must rest upon a reliable correspondence between the framework used in description and the language itself. Such a correspondence depends upon the degree to which the framework uses relationships observed in the actual data of the language, as opposed to relationships supplied from logic or mathematics. It further depends upon the degree to which the framework can successfully avoid adding assumptions not based upon observed phonetic evidence to the structure of the phonology. Moreover, it depends upon the flexibility of the phonological relationships, to insure that it is the linguist's structure which adapts, not the data which is made to adapt. Finally, it depends upon the recognition by the linguist of the fact that language serves a communicative function, manifested in the semantics and grammar, and is not merely a structure existing in a vacuum. The hierarchical model meets these criteria.

NOTES TO CHAPTER 9

¹Some dialects (for example, Bangor--see Fynes Clinton 1913: xxxii-iii) maintain the 'groove fricative' [š], which also falls into this category, though it could probably be handled as some type of prosodic variant of the obstruction /s/ (as the dialectal [z] is handled through the prosody of aspiration--see below).

²This makes no claims as to the realizations of liquids in any other language but Welsh, as each language represents its own particular structure.

³I should emphasize that a conceptual device--placing something above something in a table--ought not to be confused with the notion of relationships which the device is an attempt to convey.

⁴The term 'mutation' is traditional in the study of Welsh, and I retain it here so as to avoid confusing the issue with too much new terminology. I should note, however, that the notion of mutation traditionally implies a process relationship. For example, in soft mutation the radical is traditionally considered to change into the soft mutation form through the process of lenition. As shown in Chapter 1, this traditional notion is quite in keeping with the generative phonological approach, in which the underlying form changes into the phonological segment through some sort of process.

Although I maintain this term, I do not maintain the traditional (or generative) reliance upon the process framework (at least, not exclusively). In an hierarchical phonology, the mutation system is represented by way of relationships (for a further discussion of mutations and relations, see Lamb 1975). These relationships are morphophonological, in the Prague sense, necessitating a further level of abstraction.

⁵Note that while we do refer to a morphophoneme, there is no such element in this system as a 'phoneme'. Nor is the morphophoneme a thing or entity. One could, by the same token, speak of a phoneme as a statement of a relationship between opposition members that serves a contrastive function. I shall not press this point, as there is already much confusion in the linguistic field from a proliferation of various 'phonemes' (compare Lamb 1966a).

⁶Moreover, considering each possible change and combination of changes, we can construct an as-yet-unrealized structure of some future phonology of Welsh. Certainly, it would be a tedious exercise, but it is possible nonetheless. On the other hand, such an exercise would be impossible in the generative model, for without markedness, changes can only be described as isolated changes (in much the same manner as the

traditional process of the Neo-grammarians--compare Vachek 1966:16), and with markedness changes can only be described in relation to a set of universal interpretive conventions shown in section 6.2 to be unworkable, at best.

⁷This is more accurately described as the failure of one generation to construct a phonology consistent with the contrast patterns of the previous generation.

CHAPTER 10 THE PHONETIC BASIS

10.0 Phonetic Justification. Throughout the previous three chapters, I stress the importance of the inner approach to phonology (Jakobson and Halle 1962). The notion that the various abstracted oppositions and relations should maintain a close correlation with the observed phenomena in phonetics is not merely a device used to insure the consistence of the structure of the phonology. Indeed, if consistence were all that is needed in a phonological structure, we could greatly simplify our task by taking a treatise on logic, replacing logical symbols with letters from the international phonetic alphabet, and presenting the result as a logically consistent phonological structure. Phonology, however, has other requirements besides internal consistence, for it is a part of the complex, symbolic communications system used by human beings (compare Yngve 1975), or, at least, of a description thereof. Without a basis in the actual communicative act of speech, phonology would lack the necessary reference to the real world essential in such a system, and it is through the inner approach that we can supply the phonology with the physical as well as with the logical aspects of speech, and we need consistence with both in the analysis of language (compare Hjelmslev 1961:5-6).

The inner approach, then, is an indispensable tenet of the current theory of language. Because it is basic to the theory, I use the inner approach in the construction of hypotheses (the model)

for the description of observations (compare section 9.0). The question remains, however, as to whether the construction of the phonology in the previous three chapters is adequate insofar as the representation of the inner approach in the description is concerned. In order to test these hypotheses, we must examine the elements of the model with respect to the functional/structural theory and the observations. The direction of our inquiry is, on both counts, phonetic, for only by examining the phonetic evidence can we test the phonology with respect to the inner approach and the data upon which that approach is ultimately based. Of course, such a test represents the logical process of abduction, and the results of such a test, while determining validity in the logical sense, ought not to be taken as final.

This notion that the phonology ought to be tested through the phonetics is in keeping with most approaches (if not in practice, then in theory), though certainly not with all (compare, for example, Foley 1970b). Even in those theories which do recognize this relationship between phonetics and phonology, however, tests are seldom performed. Although experimental phonetics has provided the phonologist with evidence for oppositions or features (compare Fant 1973), there has been very little substantial evidence provided by the experimental phoneticians for phonological structures, and that evidence which does exist (for example, Mermelstein 1973--see Chapter 8) is seldom regarded by linguists. Indeed, phonologists have often gone to great lengths to demonstrate the consistence of their phonological structures and have created elaborate sets of relationships but have 'postponed' the establishment of a phonetic basis until some later time. For example, the 'dependency model' of Anderson and Jones 1974 comes very close to suggesting the

hierarchical model, but, although it does make use of features (though these are structurally rather than phonetically based--compare Foley 1970b), the system has not been devised through the inner approach, and the phonetic justifications for the relationships have been left to some indefinite time in the future (Professor Charles Jones, University of Edinburgh, personal communication).

In spite of the traditional hesitation on the part of many phonologists to test their systems against real phonetic data, I would maintain that if we are to construct a phonology which adequately represents the relationship between the symbolic language and the phonetic speech, we should spend no less time and effort in the area of phonetics (the explicit relationships) than we spend in the realm of logic (the implicit relationships). In the construction of the hierarchical model and its application in the phonology of Welsh, then, I have based my phonological relationships upon evidence supplied from phoneticians. The basic structural relationships, for example, reflect the findings of Mermelstein 1973, Öhman 1967, and others, as I mention in Chapters 8 and 9. By maintaining the close correlation with the phonetic evidence in the construction of the model, the model is, in effect, tested with respect to this phonetic evidence.

The construction of the model, however, is just one aspect of hierarchical phonology. Another very important aspect which must be tested is the use of oppositions within the model. These oppositions fall into two categories: the obstruction opposition and the prosodies. Do the members of these oppositions adequately represent observable phenomena in the phonetic data; that is, can they successfully be tested?

The use of a gradual opposition of position of articulation

(obstruction) and a privative opposition of nasality are, as mentioned in Chapter 8, well founded in the literature of acoustic and physiological phonetics. The nature of these two oppositions has been tested and retested, and the validity of using the two oppositions in their present form in a model of phonology is hardly objectionable, at least from the basis of the phonetic justification. There is one final opposition, on the other hand, which is quite open to objection, for it has no previous justification in the phonetic literature. This is the gradual opposition of aspiration.

The entire phonological system of Welsh, as I present it in the previous chapter, hinges upon the nature of the gradual opposition of aspiration. It is this opposition which determines whether the resulting 'sound' is to be a fricative or a stop, two classes which do have acoustic and physiological justification in the literature. Because of the importance of this gradual opposition to the phonology of Welsh, as it is presented in the previous chapter, and because of the absence of justification for this opposition in the literature, I present acoustic and physiological justification for it here. In addition to the acoustic and physiological justification, there is also some behavioral justification for the opposition as it is used in Welsh.

10.1 Acoustic Basis of Aspiration. One area of phonetics from which justification for the phonological use of aspiration must come is the area of acoustic phonetics. Although acoustic phonetics is considered the only valid route for the inner approach in Jakobson and Halle 1962 because of its reliance upon the effect rather than the cause of speech sound, more recent linguistic treatments of phonology, such as Chomsky

and Halle 1968, tend to avoid the acoustic justifications of phonological oppositions and structures in favor of the articulatory. Thus, before I use evidence from acoustic phonetics in order to justify my use of aspiration in the structure of Welsh, I should first provide a brief explanation, giving my reasons for maintaining the more traditional and less popular notion that acoustic phonetics is pertinent to the study of phonology.

The analysis of the speech event consists of two phonetic parts--the physiological, in which the speaker's vocal apparatus and the hearer's auditory apparatus are examined, and the acoustic, in which the sounds transmitted and received are examined. To be sure, there should be some correspondence between the two (compare Ladefoged 1962:Chapter 7), but to study the physiological aspects of speech without considering the acoustic would be to assume that the configuration of the speaker's vocal apparatus is physiologically transmitted to the hearer's auditory apparatus, that each and every aspect of the physiological state of the speaker is transmitted without loss to the hearer and is important for communication to the hearer, and that the medium of transmission neither adds to nor detracts from the actual message. Before we can safely rule out the acoustic aspects of speech, then, we must first justify these assumptions. If, moreover, these assumptions cannot be justified, then the acoustic aspects of speech had best not be avoided.

The first assumption, that the physiological state of the speaker is transmitted to the hearer's auditory apparatus through some physiological means is false, for there is no physiological connection between the speaker's mouth and the hearer's ear in normal speech communication. The speech sounds, as acoustic entities, are not only

produced by the speaker, but they are understood by the hearer. This latter point, that speech sounds are understood by the hearer in communication, may appear to be trivial, but linguists have tended to ignore it in the light of recent developments.

The recent developments which have obscured the importance of acoustic phonetics in linguistic research have to do with the motor theory of speech perception (compare Halle and Stevens 1964). In the motor theory, or analysis by synthesis, the auditory stimulus is held to be translated into articulatory responses which would be necessary if the hearer were to produce the sounds heard. It is further maintained in this theory that the perception of speech is not an act of decoding the auditory stimulus, but an act of decoding the articulatory response. Thus, incidently, it maintains the notion that it is the effect, rather than the cause, which should be analyzed. There is considerable evidence for this theory, and I do not challenge the theory per se, only the logic of using this theory as evidence against the analysis of acoustic phonetics.

The translation of the auditory stimulus into an articulatory response presupposes the reception and comprehension of the acoustic stimulus by the auditory apparatus. An argument, then, against the importance of the acoustic analysis on the basis of the motor theory's notion that it is the articulatory response rather than the acoustic stimulus which serves the phonology violates the logical notion of transitivity and is, as such, invalid. It is the acoustic stimulus which brings about the articulatory response which, in turn, yields the phonological analysis; so that, in the analysis of speech perception, the articulatory response and the phonological analysis are both

dependent upon the acoustic stimulus. Were we to disregard the acoustic stimulus, we would have no evidence for the articulatory motor response and no analysis.

Moreover, the final step in the procedure of analysis by synthesis rests upon the acoustic signal. As pointed out in Chomsky and Halle (1968:294), the synthesized product must be acoustically compared with the stimulus in order to insure accuracy. Were we to disregard the acoustic stimulus, we could further have no way of verifying the results of the analysis--the important final step in the process. The motor theory, then, in no way detracts from the necessity of understanding the acoustic signal; rather, it underscores it.

Nor should this argument be construed as an attack upon physiological phonetics. Both the physiological and the acoustic phonetics are necessary for a complete analysis, for each interacts with and is dependent upon the other (compare Lieberman 1970).

In the current acoustic theory of speech perception (see Fant 1960), the acoustic signal is analyzed into functions of frequency, amplitude, and time with respect to the sound waves used in speech. My acoustic argument for the gradual opposition of aspiration rests solely upon spectrographic analysis in keeping with the current acoustic theory. Of course, as mentioned in section 8.1, the theory is not yet theorem, but it does reflect the extent of current phonetic knowledge in this area.

In testing the validity of the opposition of aspiration in the acoustic phonetic area, we must also bear in mind that the framework is hierarchical, as proposed in Chapter 8 and developed in Chapter 9. Once again, we are proving the validity of an opposition as part of an overall phonological system by testing the opposition in its proposed

form for consistence with both the observed data and the theory.

Although, as mentioned in the previous section, the proof is abductive, it is not circular in the sense of using an hypothesis to prove itself.

A few points should be reiterated, points which are of special importance in the hierarchical framework as far as aspiration may be concerned. First of all, consonants are constraints on vowels in this framework. The members of the obstruction opposition directly constrain the syllable transitions, while the obstruction prosodies, such as aspiration, further constrain the obstructions. The nature of the prosody as a constraint should be provided in the acoustic evidence, if our test is to be affirmative. Moreover, as the opposition of aspiration operates in the phonology as a gradual opposition, we should find evidence from the examination of acoustic data for this gradual nature.

The analysis of the acoustic evidence can best be presented in the form of a phonetic experiment. The procedure consists of gathering and analyzing the data. The data was gathered in June 1974 in field conditions in Wales. Responses from the four informants mentioned in section 5.2 were recorded on a Uher 4000 Report L tape recorder at a speed of 7.5 inches per second and a distance of approximately 1.5 feet. The following corpus, in standard orthography, was read by each informant:

<u>Orthography</u>	<u>Broad Notation</u>
pahap	pahap
tahat	tahat
cahac	kahak
bahab	bahab
dahad	dahad
gahag	gahag
ffahaff	fahaf
thahath	θahaθ
chahach	xahax
fahaf	vahav

<u>Orthography</u>	<u>Broad Notation</u>
ddahadd	ðahað
llahall	lahal
rhaha	raha
lahal	lahal
rahar	rahar
haha	haha
sahas	sahas

As in normal Welsh words, stress was on the penult and pitch on the ultima (compare D.M. Jones 1949).

For analysis, the data was rerecorded from an Ampex PR-10 tape unit onto the single track Voice Identification 700 also at a speed of 7.5 inches per second. The utterances were then analyzed on the Voice Identification 700 sound spectrograph. The resulting spectrograms were organized in accordance with the structure of relationships based upon the opposition of aspiration, as found in Table 7.2.b (the nonnasal columns), in order to determine what, if any, correlations could be found in the spectrograms.

The results varied between individual speakers and between various obstruction opposition members, but within each individual and within each obstruction opposition member, the results were uniform in one particular relationship. In each opposition member of each speaker, the least aspirated member showed a low high-to-low frequency ratio of sound energy associated with the obstruction, the second member showed a greater high-to-low frequency ratio of sound energy, the third showed a greater ratio yet, and the fourth aspirate member showed a high high-to-low ratio.

An example of this high-to-low frequency ratio can be found in Figures 10.1.a-d. These represent the dental obstruction opposition member constrained by the aspirate prosody in increasing pertinent steps in the speech of Dr. Bedwyr L. Jones. In Figure 10.1.a, the

occurrence of the least aspirate prosody may be connected with the fact that the energy associated with the consonantal constraint is entirely concentrated at a frequency lower than 1500 cps in final position and 1000 cps in initial position. In Figure 10.1.b, the energy associated with the consonantal constraint is distributed more evenly, with most of the post-release energy concentrated below 3000 cps in initial position and with an 'off-glide' in final position, with most of the energy below 1000 cps and some below 500 cps. In Figure 10.1.c, the energy associated with the consonantal constraint is entirely above 500 cps in the post-release stage and with heavier concentrations above 3000 cps and traces above 5000 cps in initial position, while in final position (which this speaker pronounced in careful speech) the energy concentrations above 2000 cps are by far stronger than those below 2000 cps. In Figure 10.1.d, the energy associated with the consonantal constraint is almost entirely above 1000 cps with traces in both positions above 7000 cps.

As mentioned above, the results vary in detail between speakers and between members of the obstruction opposition in individual speakers. The variations observed, however, did not affect the basic relationships between the prosodic members of each obstruction, as far as the ratio is concerned. For example, Mr. Idris Roberts spoke with an affricated [tʰ] (compare section 1.2), reflecting the high-frequency sound of the [s] with the release characteristics of the [t] (or /dh/) mentioned above.

On the basis of the results, we can conclude that prosodic aspiration is a function of the ratio of high-to-low frequency energy in the acoustic signal. As such, it is gradual, realized as greater

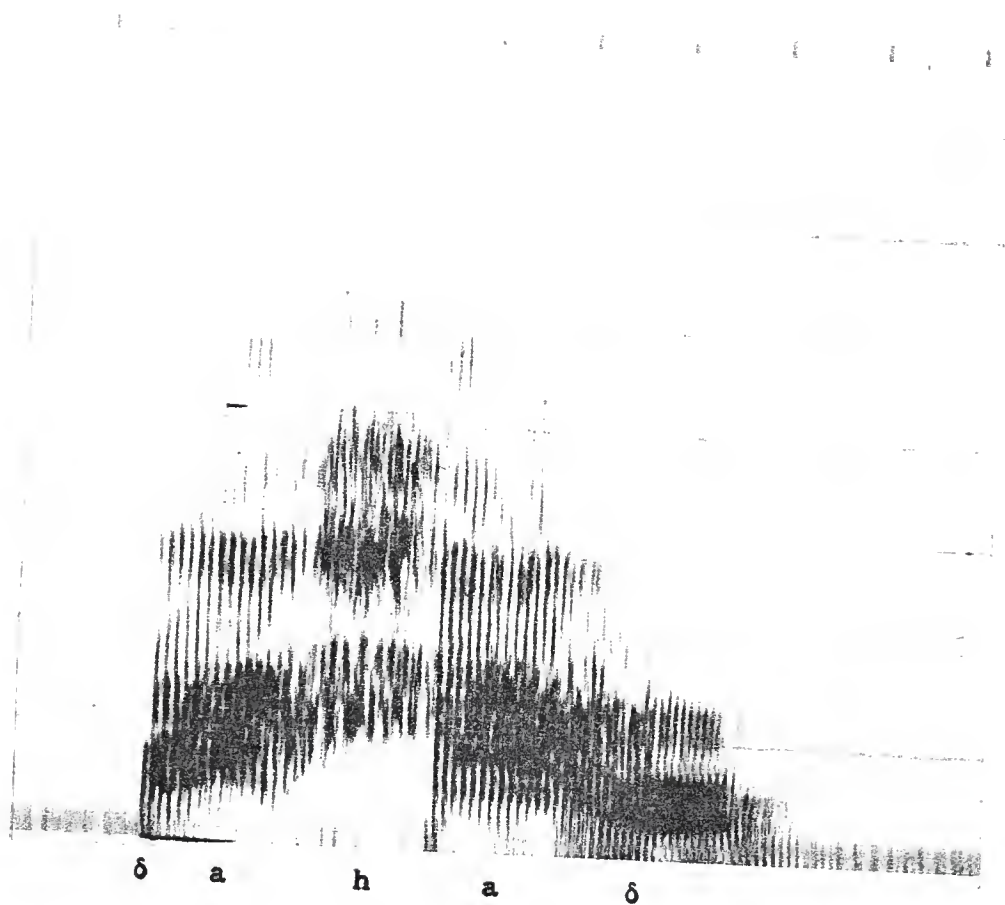


Figure 10.1.a
Utterance of [δahaδ]

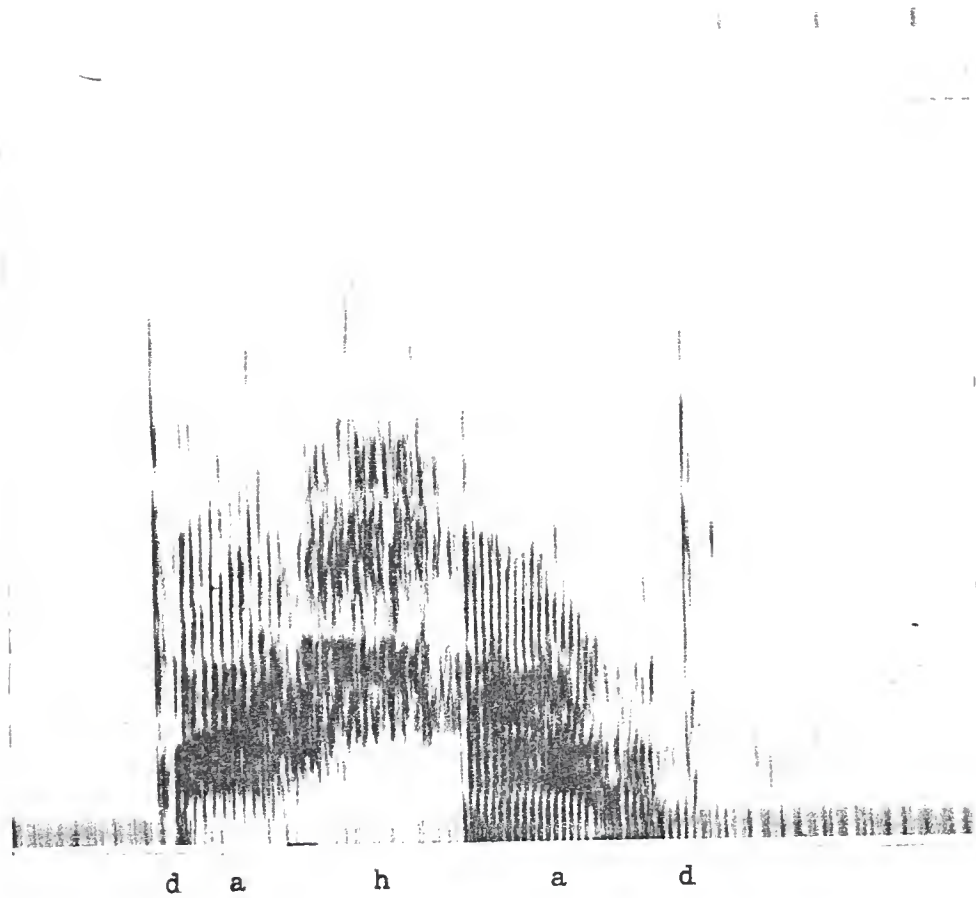


Figure 10.1.b
Utterance of [dahad]

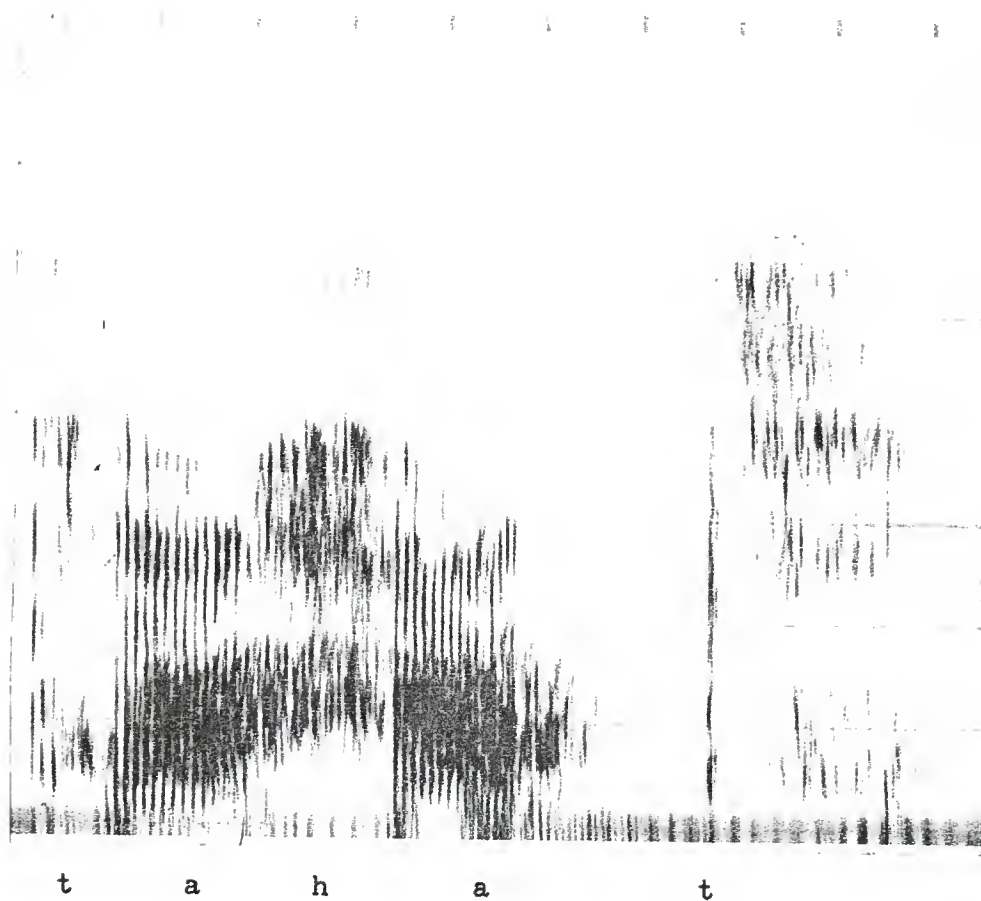


Figure 10.1.c
Utterance of [tahat]

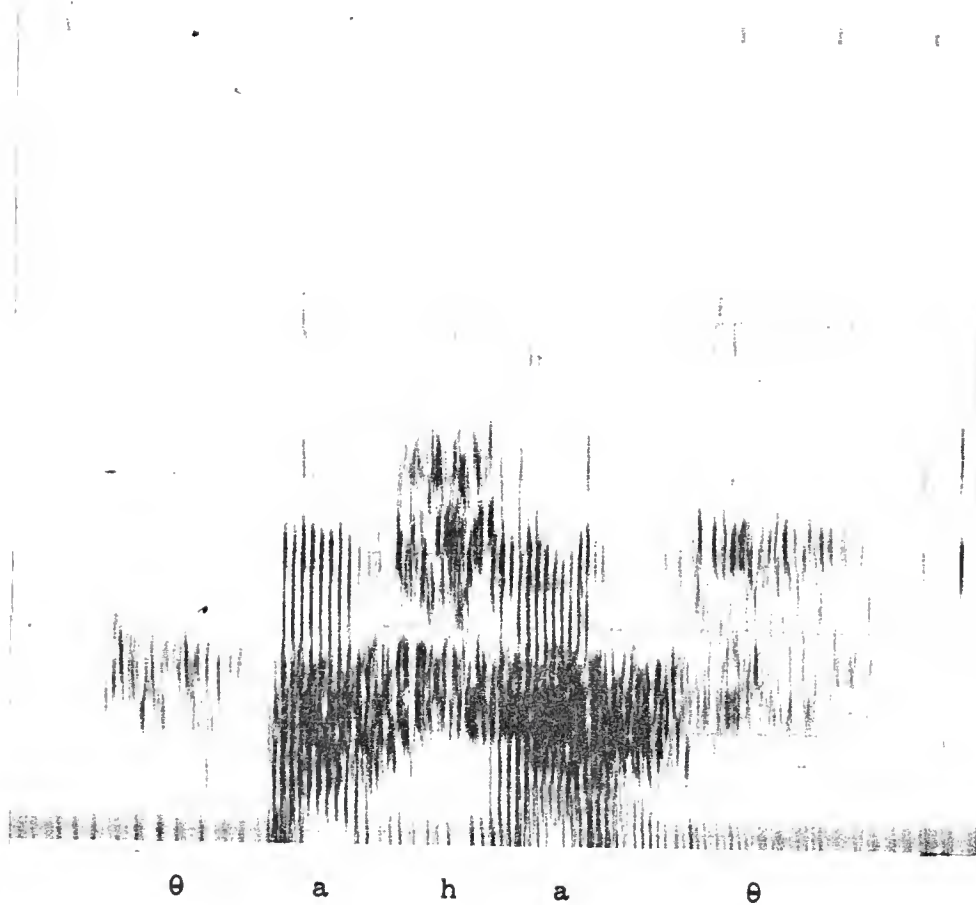


Figure 10.1.d
Utterance of [əaɦaə]

constraining force in greater degrees of aspiration. We should recall that in this model, consonants are constraints on vowels and obstruction prosodies further constrain the obstruction elements. Since the vocalic energy in the spectrogram is concentrated at the lower frequencies, as the degree of constraint represented in the degree of the obstruction prosody should increase, the obscuring effect upon the vocalic element should increase in proportion. This is precisely what occurs in the data.

Thus, the notion of a gradual opposition of prosodic aspiration is not only consistent with the hierarchical phonology, but it is also consistent with the acoustic observations. These requisites being met, the system is consistent and valid, at least so far as the acoustic aspects of speech are concerned.

Before leaving the acoustic basis of aspiration, I should like to stress two points. First, the notion of a high-to-low frequency energy function for aspiration is hypothesis, as are all analyses. It can be taken as fact only within a particular theory, so long as it is consistent with the other hypotheses and observations in the theory. As in any other science, in linguistics we can only strive for consistence in logic, and this approach tentatively satisfies consistence. Second, the acoustic relationships demonstrated for the prosody of aspiration hold only for Welsh. The phonetic detail supporting the phonological structure of one language cannot be generalized to any other language unless the other language should maintain the same phonological relationships, in which case generalization is still only a possibility. Of course, the particular acoustic characteristics of the Welsh 'sounds' will probably correspond to the 'sounds' of other languages, just as the loci and transitions of obstructions do not vary appreciably between languages,

but the organization using this ratio of aspiration can only be viewed as language specific.

10.2 Physiological Basis of Aspiration. As mentioned in the previous section, the act of verbal communication consists of two parts--the physiological and the acoustic. In order to give full phonetic justification to an opposition in the phonological structure, we must consider both aspects of phonetics. In the previous section, we find that the notion of a gradual prosodic opposition of aspiration is successfully tested in the acoustic area, that there is evidence in the speech sound wave to support the opposition and the use of the opposition in the phonological structure. We must now examine the physiological data in order to determine what, if any, physiological correlates there may be for this opposition.

We need not, however, begin our search for a physiological correlate for aspiration without any indication of what to look for. We can use the acoustic evidence of the previous section to guide our inquiry. The acoustic evidence indicates that this prosodic opposition, consistent with the hypotheses of the hierarchical phonology, occurs as a constraint with the member of the obstruction opposition. Moreover, it occurs with each member of the obstruction opposition in the same manner, being realized as a gradual constraint which serves to obscure the vocalic element proportional to its own presence.

Taking into account the constant nature of the opposition of aspiration with respect to the member of the obstruction opposition, we can probably rule out any significant influence of the articulatory musculature used in the production of the various members of the

obstruction opposition, at least from initial consideration. It is not as likely for each set of muscles associated with the different obstructions to pattern in precisely the same manner as it is for this constant ratio to be caused by the actions of some other part of the physiology which affects all obstructions without regard to the particular member. The notion that the opposition of aspiration should emanate from a physiological characteristic which is not a part of the articulatory musculature but which affects all obstructions without regard for particular obstructions is an hypothesis of hierarchical phonology (that is, it is consistent with the major premise, or theory, involved in the test of phonetic hypotheses). Furthermore, this notion also has an important precedent--the prosodic opposition of nasality affects each of the primary obstructions from a physiological characteristic not connected with the articulatory musculature, and this prosodic nasality functions in the same manner phonologically as aspiration (as a prosody). Thus, we should, at least tentatively, direct our attention away from the oral cavity.

Taking into account the nature of aspiration as a gradual constraint upon the vocalic element, we can form a further hypothesis as to the location of the physiological characteristic associated with aspiration. Acoustically, the greater the realization of aspiration, the more obscured is the vocalic element. This vocalic element is basically realized through phonation--the vibration of the vocal cords (compare Broad 1973). Indeed, the members of the opposition of aspiration can be divided into two groups, with the weaker two members insufficient to constrain voicing completely and with the stronger two members sufficient to constrain voicing completely. Of course, the voicing is an element

of the vocalic pattern. Thus, in order to locate the source of aspiration, we should direct our attention to the area around the larynx, where constraint of the apparatus used in phonation is possible. Note that this direction of inquiry does not follow from--though it is not excluded by--a segmental approach in which aspiration, or tension, is inherent, but it does follow from an hierarchical approach.

On the basis, then, of the evidence from the acoustic data of the previous section and the notions of the hierarchical phonology, we should look for a physiological characteristic in the vicinity of the larynx. This characteristic should reflect the gradual constraining force from the weakest 'voiced fricative' to the strongest 'voiceless fricative'.

The evidence supporting the gradual prosodic opposition of aspiration in physiological phonetics is found in the available literature. According to Perkell (1969:36-7), the width of the orifice of the larynx before consonant release varies in the same proportion as the strength of phonological aspiration as it is found in Welsh. Perkell's measurements are taken from a single informant recorded on cineradiographic film. The precise procedure and results of his experiment can be found in Perkell 1969.

The results as they affect the notion of aspiration constitute a test of the theory. In Figure 10.2, I give the measurements in graph form for the width of the orifice of the larynx for the nonsense words [hə'zɛ], [hə'dɛ], [hə'tɛ], and [hə'sɛ] at the point of widest dispersion, approximately 75 msec before consonant release. Phonetically, the [z] and the [s] pattern after the fricatives, the weakest and strongest members, respectively, of the opposition of aspiration constraining

the obstruction. The width of the orifice of the larynx for the weakest member is approximately 4.1 mm, for the next member 5.6 mm, for the next member 7.2 mm, and for the strongest member 9.4 mm. In each case, the orifice of the larynx expands beginning at approximately 150 msec before the consonant release and then contracts to a point of minimum dispersion at approximately 20 msec before the consonant release.

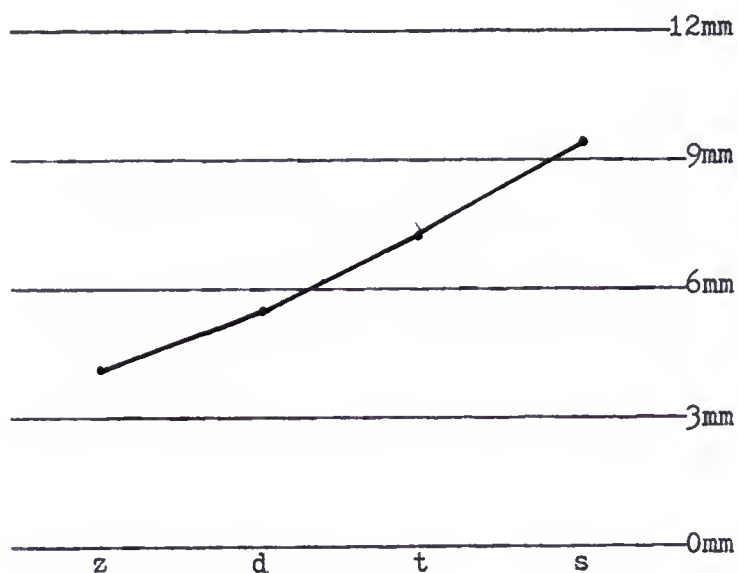


Figure 10.2
Width of the Orifice of the Larynx

The cause of the gradual increase in the width of the orifice of the larynx is open to some conjecture. Perkell suggests that the fluctuation in the width may be due to the forced expansion of the walls from some heightened pressure up through the glottis. This pressure would meet less resistance during the articulation of the 'lax' [z] and [d] than it would during the 'tense' [t] and [s]. Thus, he suggests that this could be the result of pressure and tension.¹ This reliance upon pressure and tension is the mainstay of the traditional notion of tension in phonology (compare also Palmer 1964).

On the other hand, as Perkell also suggests, the widening of the orifice of the larynx may be due to an overt muscular gesture. This notion is suggested by Ladefoged (1971:96-7) with support from Lisker and Abramson 1967 and Kent and Moll 1969.

The important aspect of the widening of the orifice of the larynx, however, is not what causes it, but what its effect is (compare Jakobson and Halle 1962; section 10.1, above). The effect of the widening of the orifice of the larynx is to draw breath into the cavity. This breath is then forced out of the cavity as the cavity closes at a rapid rate (occurring in approximately 55 msec). The force of the escaping breath represents pressure in the articulatory apparatus, pressure in a gradual amount. The higher the pressure, the more likely it is that the phonation will be obscured and that the puff of breath traditionally associated with aspiration will be emitted from the oral cavity (or, more precisely, through the oral cavity).

Thus, the widening of the orifice of the larynx reflects the gradual nature of the prosodic opposition of aspiration as well as the nature of the opposition as a constraint. Moreover, it closely reflects the acoustic situation observed in the previous section. Finally, it is consistent not only with the observed data, but also with the structure of the hierarchical phonology. As such, then, it is sufficient to demonstrate that the system proposed is valid as it stands with the gradual opposition of aspiration. As always, we have demonstrated only that the system is consistent and valid with the proposed hypotheses, not that the system is 'true' in any literal sense.

10.3 Behavioral Justification of Aspiration. The physiology of the vocal apparatus does not vary as a function of the language community.

Nor do the acoustic characteristics of sound vary as a function of the particular language spoken. Thus, we might expect speakers of German in the production of some of the 'sounds' of German to realize the same physiological configurations and to produce the same acoustic characteristics as those produced by speakers of Welsh in the production of some of the 'sounds' of Welsh. Given the species-specific physiology and the acoustic characteristics of nature, such a coincidence should not be very surprising.

Although the above-mentioned coincidence may not be very surprising, it can be threatening to the phonetic evidence presented in this chapter, if we follow either of two extremes. The first extreme would be to look at the phonetic characteristics of all languages as ends in themselves. By only examining similar phonetic characteristics in German and Welsh, we might tend to consider any common characteristics in the physiology and the acoustics to be just as important as any other characteristics. Thus, we would miss the notions of function altogether, notions which indicate that, for example, presence or absence of 'voice' serves a contrastive function in German (see section 7.2) while gradual presence of aspiration (or absence of 'voice') serves a corresponding contrastive function in Welsh. Without this notion, we could simply assign characteristics at random and completely neglect the structural importance of these characteristics (compare the binary principle, section 6.1).

The second extreme is to accept the notion of a functional phonological structure, but, in observing common physiological and acoustic characteristics between German and Welsh, to conclude that this similarity indicates similarity in structure as well. Such an extreme is most

prevalent in linguists who, upon observing the universality of physiology and acoustics, assume a further universality in phonological structures. The effect of following this extreme is precisely the same as the effect of following the first extreme--we would assign characteristics to the Welsh phonology on the basis of our knowledge of the German phonology, thus neglecting the structural and functional importance of the characteristics in Welsh.

Once we have the physiological and acoustic phonetic data, we must determine how the data is to be organized into a structure of phonology, or a system of relationships, such that it will reflect the way in which the speakers organize the phonetic characteristics in their particular language. The problem now is to find a way of determining how a speaker organizes the data.

Some linguists recognize a 'mind' which organizes the data along universal rational lines. Unfortunately, the 'knowledge' of this 'mind', in whatever form it may take, is not open to examination and cannot be verified. On the other hand, we do have evidence that language is a function of the brain (see Penfield and Roberts 1959; Whitaker 1971), so I would first consider neural evidence before considering mental or philosophical evidence. With the brain, however, we find that we still do not have the evidence necessary to determine the organization of a phonology with our current knowledge. Introspection is futile, for if we could arrive at the organization of our own phonology through introspection (or philosophy), then we could arrive at the organization of part of the brain by the same means (indeed, through the same act), which we unfortunately cannot do.

If the 'mind' and the brain are both inaccessible to phonological

research at this time, how are we to determine the manner in which a speaker organizes the phonology? One way is to ask the speaker to judge the differences between sounds. This is done in Malécot 1955 in order to arrive at various 'strength' scales. Unless the speaker is aware of each and every excitation of the aural nerves and is aware of every aspect of the physiological configurations used in speech, such judgments can only be suspect. For instance, judgments as to relative strength of tension will probably be made with reference to the speaker's oral musculature, while the actual determining factor may be in or around the speaker's larynx.

Without direct accessibility to the speaker's 'mind' or brain and without reliable judgments of the speaker, we have only one area of research left. This is the examination (and, where possible, manipulation) of the speaker's behavior--what the speaker actually utters and, where a writing system is available, writes.

The rationale, then, behind using the speaker's behavior as a basis of determining the speaker's phonology involves necessity rather than choice: If we cannot determine the cause, then we must judge the effect. Through examining the effect, we may come closer to understanding the phenomenon of which the cause is an integral part.²

In using a behavioral approach in determining the organization of phonological structures, I should emphasize that we are not using a 'behaviorist' approach, such as that of Skinner 1957, the frailties of which are exposed in Chomsky 1959. Behaviorism is simply a subset of behavioral studies, and a relatively small subset at that. To judge any reliance upon behavioral data in terms of the behaviorist notions is to give an argument in the extremes which is analogous to the contention

that a transformational generative approach is basically genetic (compare Staats 1971).

The behavioral evidence (that is, the data supplied by what the speaker actually says or writes), gives considerable support to the notion of the gradual prosodic opposition of aspiration. This evidence has, in fact, already been presented in Chapter 7. But I should briefly summarize the evidence in the light of the hierarchical model and the phonetic evidence presented subsequent to that chapter.

Much of the evidence for the opposition deals with the mutation system's relationships. In soft mutation, there is an overt loss of what is traditionally thought of as aspiration in several of the instances. On the other hand, in the aspirate mutation in nonstandard applications to consonants, there is the addition of such aspiration. In the hierarchical phonological framework, this can be explained as a result of the organization, for the addition or loss of aspiration results in the realization of the same member of the obstruction opposition with a constraint by the higher or lower aspirate opposition member. Phonetically, the relationships involved are connected physiologically and acoustically through the reference to particular gradual, constraining characteristics.

In historical lenition and provection, we find basically the same sort of phonological and phonetic relationships. In synchronic provection, however, the evidence is more compelling, for the speaker uses an aspirate or geminate provection form as an equivalent of the same member of the obstruction opposition constrained by the next higher degree of prosodic aspiration. Again, the phonetic characteristics of this relationship are in keeping with the proposed structure.

As far as spelling is concerned, the older spellings of the fricative 'liquids' with an h and the development of the spirant mutation with the spelling of the 'voiceless aspirated stop' with an h reflect an association between the members of the opposition of aspiration which is identical to that found in the hierarchical phonology and that supported by the phonetic characteristics.

Thus, the behavior of the speaker is parallel to the phonological organization of the hierarchical model in its treatment of the physiological and acoustic data. If the behavior reflects the actual mental or neural organization of the language, then it supports the hypothesis that the speaker organizes the phonology such that there may be a gradual opposition realized as phonetic aspiration.

The process of justifying the notion of a gradual opposition of aspiration as an obstruction prosody in the hierarchical model has now gone the full circle. While we need to justify the phonology through the phonetics, we must also justify the phonetics through the phonology. If both justifications are sound, then we have a consistent and valid system of relationships. In science, consistence and validity with respect to theory and observation represent our only path to knowledge.

NOTES TO CHAPTER 10

¹To be sure, he also mentions the possibility of an overt gesture--see below.

²Compare also the relationship between cause and effect in the use of acoustic rather than physiological phonetics in Jakobson and Halle 1962.

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BIOGRAPHICAL SKETCH

Toby D. Griffen was born on May 12, 1946, in Washington D.C. He is the youngest son of Captain Ira P. Griffen (USN, Ret.) and Mrs. Gladys Griffen (née Oney). After attending public school in Bethesda, Maryland, he enrolled as a cadet at The Citadel, The Military College of South Carolina, and graduated in 1968 with a B.A. degree in Modern Language and a commission in the U.S. Army Reserve. From here, he attended the University of Virginia, earning an M.A. degree in German in 1969 and studying for one year beyond the degree. In 1970, he reported for active duty in the Army, serving as an officer in the Military Police at Fort Eustis, Virginia. With his active duty behind him, he enrolled in the Program in Linguistics at the University of Florida in 1972.

His publications include 'The development of Welsh affricates, a change through borrowing' (Lingua 34.149-65), 'On describing the cluster prosody' (LACUS Forum 1.140-7), 'Lenis initials in Welsh borrowings' (to appear in Language Sciences), and 'Toward a nonsegmental phonology' (to appear in Word). Papers presented include 'The archiphoneme in generative phonology' (SECOL XI), 'On describing the cluster prosody' (LACUS I), 'The interaction and description of phonologies in contact' (SECOL XII), and 'Stratificational grammar and an hierarchical phonology' (SECOL XIII).

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Bohdan Saciuk, Chairman
Associate Professor of Romance
Languages and Literatures

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Chauncey Chu
Associate Professor of Romance
Languages and Literatures

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



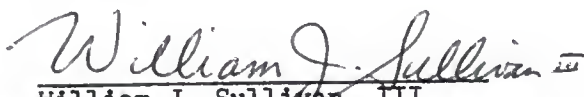
Donald Dew
Associate Professor of Speech

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Eileen A. Sullivan
Assistant Professor of Behavioral
Studies

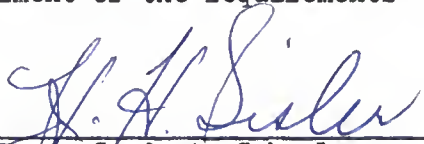
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William J. Sullivan, III
Assistant Professor of Germanic and
Slavic Languages and Literatures

This dissertation was submitted to the Graduate Faculty of the Program in Linguistics in the College of Arts and Sciences and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dean, Graduate School



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